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The Great Falls Coalfield in Montana

Amalgamated Copper Company Is One of the Largest Coal Producers in the Northwest. Tail-rope Haulage Pulls 3500 Tons in 10 Hours

BY A. T. SHURICK*

The Great Falls coalfield, from a commercial viewpoint, occupies a position probably unrivaled among the western coal operations and even with the high ash content of its coal, it ranks as the largest producer in Montana.

The area of workable coal included in this field is roughly about 230 square miles, its general dimensions being about 30 miles long by 8 miles wide. The term "workable coal" as here used is a misnomer, and signifies only its economic value from a consideration of the surface cover; in much of this area the coal will be found too thin to permit of its development as a practical coal-mining proposition, in the present era at least.

On the United States Geological Survey map, showing the coalfields of the United States, the Great Falls field lies in the western portion of the Judith Basin region on the extreme western border of the Northern Great Plains province. It is here classified as a bituminous coal, being one of the only two fields in Montana so classified.

The geology as a whole is simple, the measures being practically horizontal and no faults or displacements of any magnitude have yet been discovered. The principal coal horizon occurs about 60 ft. above the base of the Kootenai (Lower Cretaceous), which formation is here about 475 ft. thick, and is composed of alternating shales and heavy sandstones. Massive sandstones predominate near the bottom adjoining the coal horizon, and in some instances forming ideal roof and bottom conditions.

Probably an average haul for the entire field to Great Falls would be 18 miles, and to Butte 180 miles. It represents clearly the most Northwestern coalfield of any magnitude in the United States, and will doubtless continue to be the predominating coal district from Great Falls to the coast.

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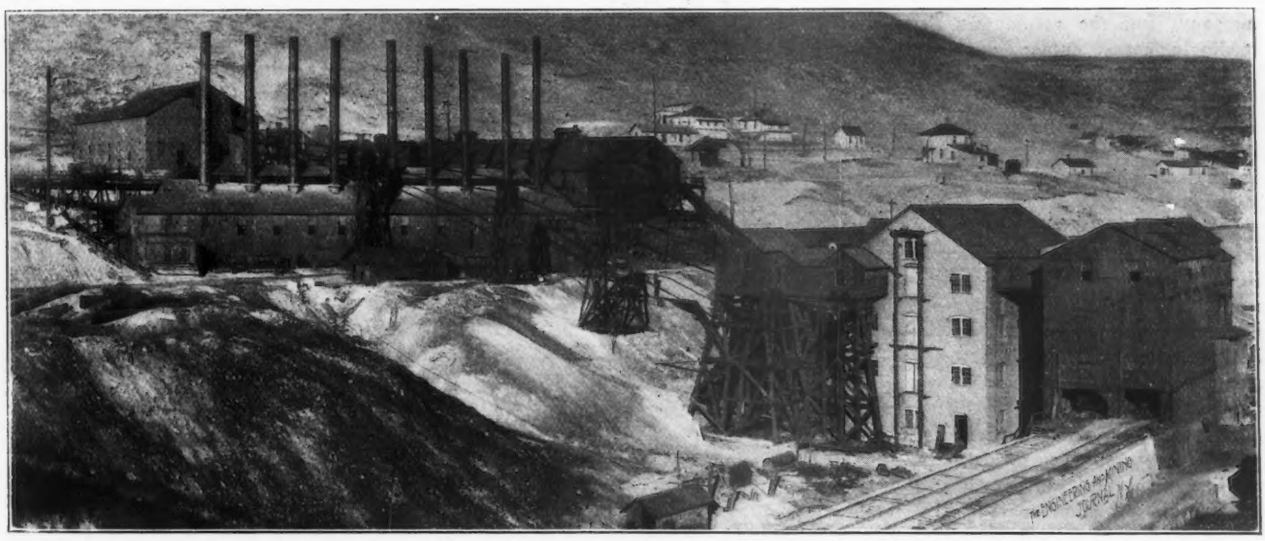


SURFACE PLANT AT THE BELT MINE SHOWING TIPPLE AND WASHERY BUILDING

Past and Present Operations

The first authoritative examination of this field, of which there is any record, was made by members of the Transcontinental Survey in 1879. It was later reported on by Newberry acting for the Great Northern Railway, and again in 1891 by Weed of the United States Geological Survey, who submitted a very comprehensive report.

The westernmost portion of the field, or what is known locally as the Smith River district, has probably the thickest seams in the entire field; prospects in this vicinity show 18 ft. of coal with the usual interstratified bands of slate and bone. The district has no shipping facilities and consequently no extensive development has been done.

The Sand-Coulee district, lying about the center of the field was the first heavy producer, and at present has the largest output. Three important operations predominate; the Cottonwood Coal Company, the Nelson Coal Company, and the Gerber Coal Company, with a more than usual strong following of smaller operations, ranging from prospects to the largest operation practicable without steam equipment.

The Cottonwood Coal Company (a subsidary of the Great Northern Railway) is the pioneer of the entire field and by far the largest operator in this particular district. They began active operations at Sand-Coulee in 1888 on the completion of the railroad, and produced about 300,000 tons in that year. Later, they changed their principal base of operations to Stockett, about five miles around from Sand-Coulee, where they have a complete equipment, including a washing plant unique in the history of the western coal industry. (See "A Bituminous Coal Breaker," Trans. Am. Inst. of Min. Eng'rs. Vol. 35 Stockett.)

The first work done in the Belt Valley

district was in 1877 and from then until the advent of the railroad, in 1889, from 500 to 1000 tons per annum was freighted across to Fort Benton, which was then the head of navigation on the Missouri river, and much of the fuel was used to coal the steamers down the river.

In 1891 the Anaconda Copper Mining Company secured a lease on the Belt mine and succeeded in shipping sufficient coal to Butte to seriously threaten Wyoming operators who controlled this market, and brought about a much needed adjustment of prices. This was continued until 1894 when they bought the property outright and immediately started developing for a large output.

The Anaconda Copper Mining Company's Belt Mine

The Belt mine, which is probably the largest coal mine with a single opening in the Northwest, is selected for detailed description:

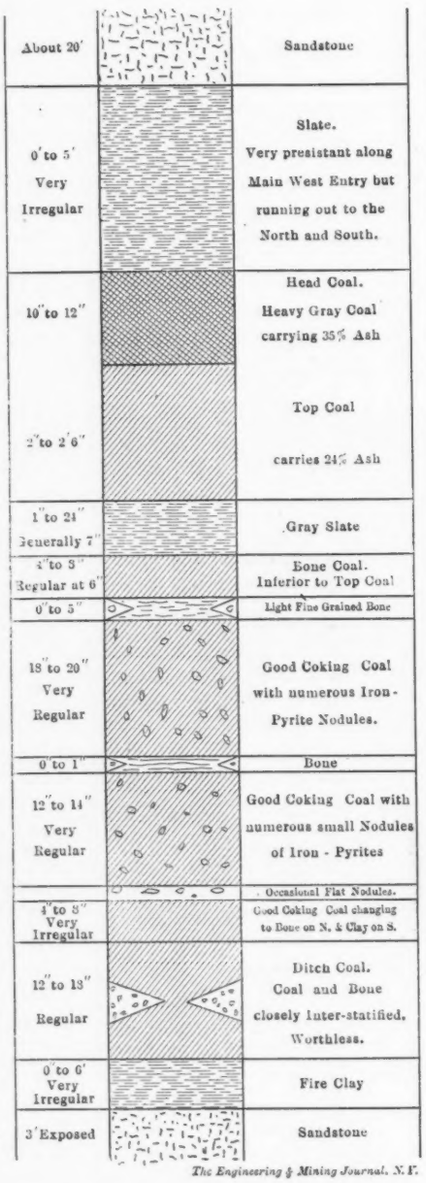
At the time of the acquirement of this property by the Anaconda Copper Mining Company, it was the only producing coal property directly controlled by that company, and the result was that exceedingly heavy output demands were made upon it. Much credit is due the coal-department officials in meeting these demands, as they were probably unprecedented, even among the modern plants of that day in Pennsylvania and West Virginia.

Owing to the comparatively extreme irregularity in dips, both in pitch and direction, it has been necessary to adopt a more or less flexible system of working. The Main West entry, which is the main haulage-way was driven in 3300 ft. when an area of low coal, which came in with a pronounced upthrow in the bottom, was developed by the north entries; the Main West entries were then turned paralleling the line of the fault, and are now in 7600 ft. in this direction making the total distance from the mine mouth a trifle over two miles. In on this new course 1600 ft., a "hill" of such magnitude was encountered, that, for haulage purposes, it was found necessary to develop around it. The entries were turned on their original course again for 1500 ft., and then back at a rather sharp angle toward the Main West for 1800 ft., this being the present inside point of the main haulage. This haulage-way, including a short outside haul, is 7000 ft. long and 48 car trips, of 2¼ tons to the car, are pulled by the tail-rope system.

The track is laid with 30-lb. rails, both main and tail ropes are 1 in. in diameter, and the trip attains a speed of a little over 8 miles per hour. The maximum grade is 3 per cent, and is against the loads; 3500 tons of coal have been pulled in 10 hours on this haulage-way, before it was extended to its present length, and if the rock had been included it would probably have been close to 4000 tons. Partings 550 ft. long are required as sidings on which to make up the trips, and there are at present two such partings, one at the 16th entry draining the territory from there into the face, and the other at the 12th entry to pull pillar coal from the south side.

Engine-Planes are Used

The secondary haulage is accomplished



A DETAILED SECTION OF THE COAL SEAM AT THE BELT MINE

on the engine-plane system, with horses acting as auxiliaries in making up the trips. These engines, of which there are 8 in use, are duplex- using compressed air and ranging from 6x8 to 8x10 in., and use from ¾-in. to ⅞-in. wire rope. They are located in the more elevated portions of the mine so the loads run by gravity to the partings on the Main West, and the empties the same to smaller partings near the working face; from this latter point the empties are delivered to the working places by horses and the loads are made up into from 8 to 12 car trips. Eighteen horses are used on this work.

The System of Mining

The general system of mining is simple, the main haulage centering on the Main West entry and cross entries being driven to the North and South with perpendicular distances of usually 500 ft. between them. All entries are driven on the usual double-entry system, with a 25-ft. pillar, and crosscuts about every 100 ft. Fig. 2 shows a portion of the inside workings typical of the mine as a whole. The contours, showing the topography of the bottom of the coal, exhibit clearly the irregularities of dip.

Rooms are turned every 50 ft. off those cross entries on both sides, and where the topography permits, are driven at right angles to the entry. It is essential that the rooms be driven slightly on the raise in order to be self draining, the mine being very wet; in some instances, however, where it has been necessary to go to the dip for short distances, the "Finlander Pump" (a tub set up near the roof with a trough leading to the room mouth) has given satisfactory results.

The most desirable room-and-pillar dimensions have been found to be a 30-ft. room with a 20-ft. pillar; a 30-ft. room with a 10-ft. pillar was attempted in one portion of the mine but resulted in a large and rather expensive squeeze. Where roof conditions are the best, a 50-ft. room and a 30-ft. pillar are used, the room being laid with two tracks one up each rib.

Mining is done entirely by the puncher machine; the company has about 30 of the Ingersoll-Sergeant Type G 2 machines, of which about 20 are in use at the present time. The machines work under severe conditions, the mining being hard and the seam thoroughly impregnated with exceedingly hard nodules of iron-pyrites. Eighteen picks are required per machine, per eight-hour shift, and the average work done by a machine is a cut 45 ft. long and 4 ft. 6 in. deep.

Miners' Wages

Machine runners are paid 11c. per ton, helpers 9c. and loaders 43½c., it being the duty of the latter to shoot the coal and keep the timber and track up in his place. Inside wages run from $3.25 to $4.00 for eight hours at the working face.

The mine is generally self draining, although in some of the lower portions small compressed-air pumps are required.

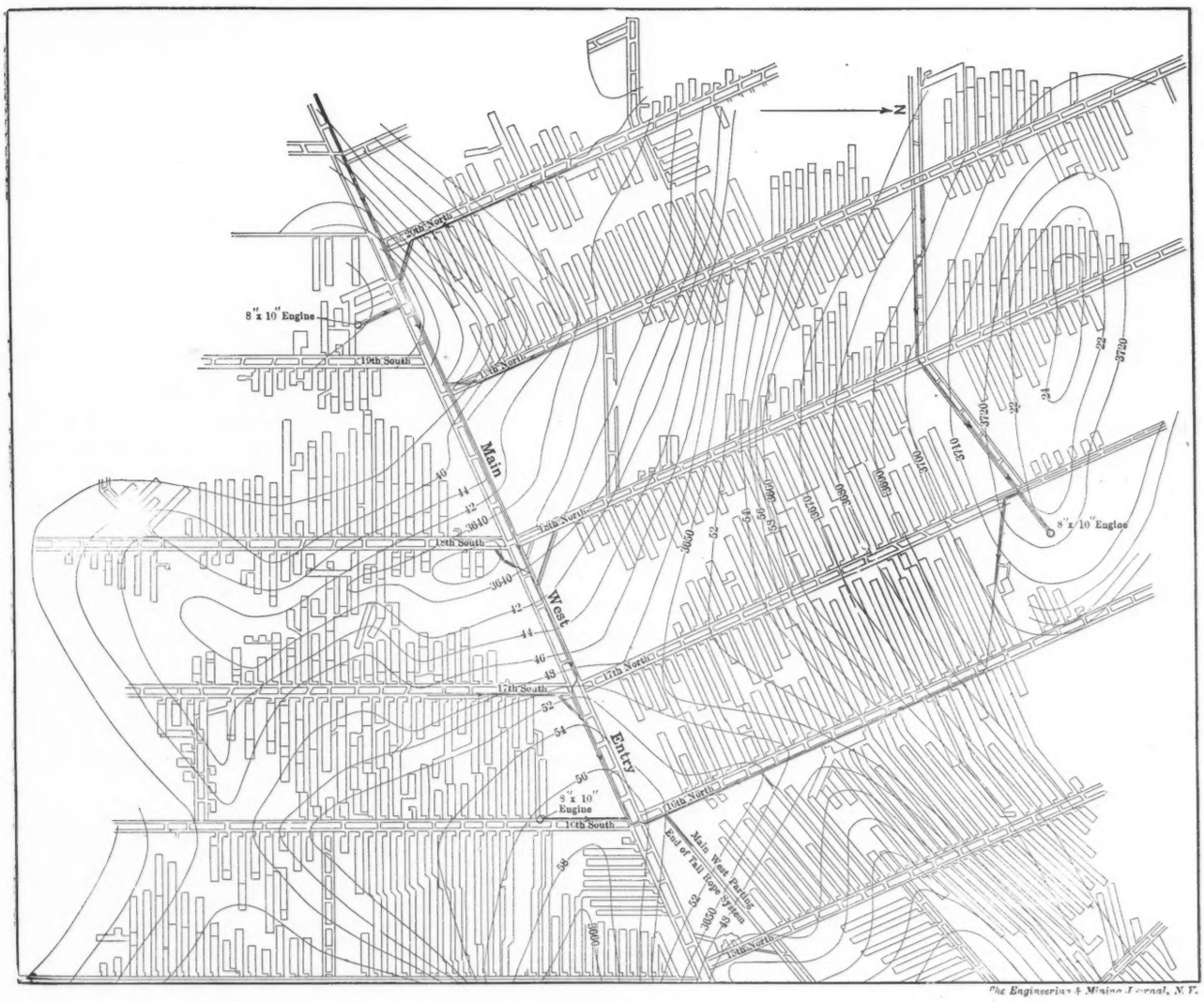
The ventilation is simple, the air being forced in through all working places to an up-cast shaft near the extreme inside workings, having a motive column of about 350 ft. The fan is of the Guibal type, 20 ft. in diameter, and driven by

a 12x16-in. engine direct connected. The mine has never been known to show any firedamp, which together with its exceeding wetness, and its generally good roof, places it among the safest mines in the west.

The Coal

An accompanying drawing shows a section of the seam as it has been developed in this mine, showing clearly the maximum thickness of the coal-bearing strata which has been encountered, and the minimum which it has been found economical to work, together with the individual peculiarities common to each of the strata, such as its total change of character and uniformity.

This section forms an interesting exhibit of the persistent irregularities common to the western coals; it would be possible to compile many different sections from the one here shown, and the geologist would be puzzled to correlate them, were their stratagraphic positions unknown. A rough average analysis would be 51 per cent. carbon, 27 per cent. volatile, 18 per cent. ash and 3 per cent. sulphur. The foregoing analysis shows the one serious trouble of the field, the high ash content, for which the top coal is directly responsible. The bottom bench of coking coal was at one time mined separately and produced a coke that was equal to the Connellsville coke both in composition and physical structure. The ash content, in the coal, however, by the very thorough treatment outlined below, is reduced to 6.5 per cent.



MAP OF THE BELT MINE SHOWING ENGINE PLANE HAULAGE SYSTEM AND TOPOGRAPHY OF SEAM. ARROWS SHOW DIRECTION OF HAUL

The Surface Plant

The difficult treatment of the coal, made essential by the high ash content, and the large amount of power required in mining and hauling the coal inside, necessitates a rather elaborate surface equipment. The boiler plant is equipped throughout with the Tuttle Manufacturing and Supply Company boilers, there being ten 60 in. by 16 ft. and seven 54 in. by 16 ft. The boilers are located in batteries of two, there being one stack for each battery. A feature in connection with the boiler house, the importance of which is probably not generally appreciated among coal men, is the practice of carrying the weight of the large stacks on the roof trusses. In this case the boiler house is built of steel throughout, but a queen truss (which is generally the limit of the average mine carpenter) built up of 8x10 in. timbers, will readily carry any ordinary load of this character on spans up to 38 feet.

Power Plant

Compressed air is furnished by a Corliss Cross compound condensing air compressor 24x48x24¼ in. on the high pressure side, and 44x48x24¼ in. on the low. A smaller compressor, 24x30x24¼ in. acts as an auxiliary to the large one. Power is furnished the washer by means of a 300-h.p. rope-transmission system consisting of a 24x48 corliss engine driving a

20-ft. diameter wheel from which five 2-in. diameter manilla ropes run to the washer 235 ft. distant.

The electric-light equipment, furnishing about 1100 lamps from 16 c.-p. to 32 c.-p. for the works and the town, consists of a 12x12x20x12-in. Westinghouse compound high-speed engine driving a Westinghouse single-phase 1100-volt 50-ampere dynamo.

The haulage engine operating the tail-rope system consists of two 15x18-in. cylinders driving directly a 6-in. shaft, which in turn gears back to two drums in the proportion of about 1 to 6. The two drums are 5 ft. 6 in. in diameter with 6-ft. faces and are so connected up that they may be thrown in and out of gear separately.

The machine shop is equipped with a lathe having a 26-in. swing and a 11-ft base, a milling machine with a 42-in. base, a drill press with a 36-in. swing and a 6-in. pipe cutter all run by a 6x8-in. vertical engine. The blacksmith shop has five forges and an 800-lb. steam hammer.

The tipple is equipped with three Phillips dumps, one for coking coal and two to handle the run-of-mine, and owing to the large size of the trips, two stationary engines are used to handle the cars on the tipple. One engine, a 6x8-in. single cylinder vertical "dummy" pulls the loads down to the tipple by means of an ingenious endless-rope system using 1½-in. manilla rope. The other engine is the usual duplex mine haulage engine with 6x8-in. cylinders, and pulls the empties back up into the mine. A 30-in. circular saw driven by a 6x8-in. vertical engine is conveniently located to where the empty trip stands, and props are thus readily sawed to the required length and loaded.

The Washing Plant

The washery has two board divisions, one handling the coking coal and the other the non-coking. The greater part of the equipment was made at the company's foundry and machine shops in Anaconda.

The non-coking coal on being dumped at the tipple passes down through two 24x30-in. crushers, one reducing to 4-in. and the other to a 2-in. size. The crushed coal passes into a Dodge conveyer which carries it to storage bins in the washer. This conveyer works on a 10-deg. pitch against the "loads," is 150 ft. long, and has a capacity of 800 tons in eight hours.

From the storage bin, which holds 700 tons, the coal is elevated and distributed to three Jeffrey-Robinson washers each having a theoretical capacity of 400 tons and an actual working capacity of about 350 tons. The clean coal from the washers is elevated into the washed coal drainage bins having a capacity of 800 tons, whence it is loaded into railroad cars and shipped for steam coal. The refuse is again elevated and fed by means of a screw conveyer and a sluice box into two jigs each having a capacity of 20 tons in eight hours; these two jigs recover about 20 tons of sulphur nodules which are shipped to Great Falls and used at the smelters. The coking coal, on being dumped at the tipple, feeds into a conveyer similar to the non-coking coal, but with only 600 tons capacity, whence it is delivered to the coking-coal division of the washer.

The method of treating the coking coal is so complex that a description of the equipment only will be attempted here. The first floor consists of five tanks which act as temporary repositories for the refuse and different sizes of coal pending their elevation for retreatment or final disposal. On the second as well as on the third floors, there are 10 jigs, all of the Luhrig type. The second floor has a crusher and the third floor a crusher and screen, the latter sizing to over ½ in. and under ⅜ in. The fourth floor has two 6x4-ft. screens and one 8x10-ft.; the latter having a capacity of 400 tons in eight hours and sizing the coal to over 1½ in., 1 in., ⅜ in. and under ⅜ inch.

The elevating equipment consists of eleven elevators having a range of work from the first to the fourth floor. The building itself is of brick and steel throughout. One hundred coke ovens of the usual beehive type, 12 ft. in diameter, extend out from the washed coking-coal drainage bin, the coal being delivered to the ovens by means of a six-ton larry pulled by a horse.

Electrolytic Determination of Nickel

By V. P. Davis*

Dr. August Schumann, of Eisleben, has just published some results of analyses and experiments (*Zeits. f. angew. Chemie*, Dec. 18, 1908—2579) carried out under his personal supervision in which he confirms the inaccuracy of Professor Classen's method for the quantitative determination of nickel by electrolyzing the double oxalate. Some new methods are detailed which Doctor Schumann considers entirely trustworthy. The work is yet unfinished, therefore full details of manipulation are lacking, except in the analysis of pure nickel salts; but certain facts seem to be definitely established.

The metal must "plate" on the cathode; that is, deposit in coherent form, not as "sponge" or "moss." Negative metals, such as copper, antimony and arsenic must be absent. The presence of iron, manganese and aluminum is permissible only in small amounts. Chlorides and nitrates, when properly dealt with, give perfectly reliable results, contrary to the present generally accepted opinion. The best results are in every case obtained with a strongly ammoniacal electrolyte. The addition of soda pyrophosphate as recommended by Brand is an unnecessary complication, results with and without its use proving identical.

Weston's boric-acid method is applicable only when using a platinum dish or wire gauze as cathode. With a conical or cylindrical cathode the nickel deposited spongy and could not be weighed. Treadwell's recommendation, consisting in the addition of a small quantity of sulphuric or hydrochloric acid, to the electrolyte, is criticized as untrustworthy. Results by this method failed to cheek within allowable limits.

The obvious disadvantages of a strongly ammoniacial electrolyte have been met in part by the substitution of ammonium carbonate; though final report is yet to be had in this connection. An improvement in the cathode is the use of a piece of platinum wire gauze in place of the customary dish or cylinder. The gauze presents the advantage of lower first cost on account of its light weight, ease in cleaning, and the fact that it unfailingly deposits bright coherent metal. Faultless results are obtained with a low-current density and the addition of a certain amount of ammonium sulphate to increase the conductivity of the electrolyte. Following is a description of the analysis of nickel-ammonium sulphate: Electrolyte, 150 c.c. (including 40 c.c. ammonia); separation of electrodes, 1 c.m.; voltage, 6.14; temperature, 60 deg. F.; amperes, 0.37; time, 4 hours; Ni present, 0.1828 grams; Ni found, 0.1828 grams.

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Osceola Mining Company

This company reports for 1908, with comparison to two previous years, as follows:

	1908.	1907.	1906.
Cop. sld., lb.	19,815,046	11,080,210	18,588,451
Price, cents	13.39	18.17	18.89
Unsold cop	1,435,748	3,054,543	.....
Gross earn.	$2,914,544	$2,481,306	$3,646,811
Oper. exp.	2,091,824	1,674,178	1,868,140
Gross prof.	$822,720	$807,128	$1,788,671
Construction	145,615	84,373	155,482
Net profit	$677,105	$722,755	$1,623,189
Dividends	576,900	673,050	1,153,800
Surplus	100,205	49,705	469,389
Prev. surp.	1,386,869	1,337,164	867,775
Total surp.	$1,487,074	$1,386,869	$1,337,164

Mining statistics for the year compare as follows:

	1908.	1907.	1906.
Tons rock std.	1,241,400	811,603	1,016,240
Lb. min. ob.	26,912,944	18,607,747	24,227,281
Fine cop., lb.	21,250,794	14,134,753	18,588,451
Cost per lb. at mine	8.74c	10.59c	8.73c
Cost per lb., smelt., frt., other chgs.	1.10c	1.25c	1.32c
Tl. cost per lb., refined	10.53c	12.44c	10.89c

The deepest vertical shafts on the Rand are the Cinderella Deep, which is 4200 ft. deep and the Jupiter, 4230 ft. deep.

Placer Gold Mining in Interior Alaska

The Fairbanks, Tanana and Koyukuk Districts Offer a Promising Field for Prospecting, Lack of Transportation Being the Chief Obstacle

EXCERPTS FROM A PRIVATE LETTER

Placer mining in its different forms is the principal industry of all interior Alaska. The production of gold in the Territory for 1906 was $18,600,000; and for 1907, $16,400,000, the decrease being due to labor troubles and the lack of labor. Half of the total amount produced in 1907 came from the Fairbanks district, but gold is being produced from the gravels in many places throughout Alaska. The number of places producing gold is increasing annually and I think will continue to do so for a long time to come. The staking of large areas by power of attorney has deterred prospecting a great deal, particularly in sections near producing camps. There are hundreds of square miles of territory, however, that has been neither prospected nor staked.

General Conditions in Alaska

Poor transportation is the greatest obstacle to mining in the interior. Means of conveyance are controlled by one or two companies, practically to the exclusion of all others. Projected and partially built railroads from the vicinity of Valdez, on the coast, into the copper districts in southern Alaska will, when completed, no doubt be a great help to the Tanana valley and a large area in that vicinity. Were it not for the high price of equipment much ground which is now valueless would be productive. Such favorable conditions will no doubt be brought about in a few years. The Koyukuk country, on the headwater of the Koyukuk river, in which very rich discoveries have been made lately, gives promise of being a large producer in the near future. The Koyukuk river lies north of and flows in a course almost parallel to the Yukon river into which it empties about 600 miles from the mouth.

Good reports come from the Valdez Creek country, about 200 miles southwest of Fairbanks and about the same distance from Valdez. It empties into the Susitna river, which in turn empties into Cooks Inlet. It is a very inaccessible district and supplies are expensive. There are some very rich gravels on the rimrock and on benches in a few places, but on the creeks the prospectors have not reached bedrock on account of the water. There is no machinery in the district. Miners are bothered with large boulders in places I understand. The gold is coarse; $1,000 was paid for a single nugget found in this district.

There is a great deal of coal as well as copper in many parts of interior Alaska as well as on the coast. Prospecting is handicapped somewhat by conditions, by frozen gravel and by the fact that the country is generally covered with a growth of moss or tundra. This accounts largely, in my opinion, for the lack of quartz discoveries in the interior.

The total population of the interior of Alaska will hardly exceed 5000, and the small number actually prospecting, under conditions which make prospecting laborious and slow, indicates how much of Alaska still remains to be prospected. The drilling machines are working, mostly, for an interest in the ground they prospect. The interest usually given is one-half, and the number of holes drilled from 6 to 12 on claims of 20 acres, or about this proportion.

There have been some new discoveries of good pay ground lately on Engineer and Lower Goldstream creeks, also on Little Eldorado creek, both near Fairbanks. A few days ago I saw a pile of ten gold bars in the window of the bank in Fairbanks. They were the result of sluicing operations during the winter months.

It takes about 25 or 30 days for mail to travel from Fairbanks to the United States in winter *via* stage; there are two stages a week from Fairbanks to Valdez. In summer it takes a little longer *via* steamboat, to Dawson and White Horse. No outside mail comes in *via* Nome or St. Michaels.

Methods of Mining

The methods and costs of mining vary with conditions and locality. The methods in the region about Fairbanks where most of the gravel is from 50 to 300 ft. deep to bedrock are: Sinking shaft to bedrock, drifting along the course of the pay gravel and driving crosscuts from main drift to both limits of the deposit. The pay gravel is extracted by breasting out the crosscuts beginning at the farther limits of the drifts and working toward the shaft. The pay gravel is hoisted with as little waste as possible, and is sluiced for the recovery of the gold. The main drifts are usually carried about 200 ft. each way from the shaft and timbered. The crosscuts are seldom timbered, for in most cases the gravel is solidly frozen and usually permits of breasting without the use of timber, the work being carried on in two or more of the crosscuts as desired. Work in this case means thawing the gravel, usually by steam, and extracting by pick and shovel. While extracting the gravel in the breast on one side of the drift, thawing is in progress on the other side. The steam point generally used for thawing is a piece of round hollow soft steel about 8 ft. long with a blunt hollow point of tool steel for piercing the ground, and a solid head of tool steel made strong enough to drive with a hammer. Steam is admitted through a pipe fitted laterally to the head. Hot water is, however, more frequently used for driving the points into the gravel and the thawing completed by means of steam. This has been found to be more rapid and satisfactory as a rule. The points are placed about 2½ ft. apart and require from 1 to 2 boiler capacity per point. In most places the points are left in the ground from 15 to 24 hours each thawing from 3 to 5 cu.yd. or more.

In many cases where a larger amount of ground is blocked out the points are left in the ground 10 or 12 hours and then withdrawn to be used elsewhere, the ground being allowed to "sweat" as they term it, thawing continuing for several hours after the points have been withdrawn, owing to the heat radiated from the thawed gravel.

Hot water hydraulicking by means of pulsometer or pumps of other types has been successfully used in some places and I think could be advantageously employed more generally.

After thawing, the gravel is removed by pick and shovel and carried by wheelbarrows or cars to the shaft, whence it is hoisted to the surface by buckets, generally attached to an automatic carrier or traveler which permits the dumping of the gravel directly into the sluice boxes, located 100 ft. or more from the collar of the shaft. In winter the gravel is conveyed to a dump under which sluice boxes have been placed, and is passed through the boxes in the spring when snow and ice begin thawing and water is available. Winter work is therefore somewhat more expensive. Gravel must average more than $2 per cu.yd. of ground worked in order to pay a profit in drift mining. Wages are $5 and board for miners, $7 for engineers and mechanics, and $10 for foremen.

Other Methods

Open-cut mining is carried on in a few places where the gravel is shallow. The ground is stripped either by sluicing or

with scrapers operated with steam or horsepower. Sometimes the gravel is thawed by steam, occasionally by exposure to the sun, and frequently by running water over it, when water is available. In the latter case bedrock drains are usually constructed and some means of elevating tailings employed. The usual method for handling the gravel after it is thawed is either by shoveling into wheelbarrows carrying it to the bucket in which it is conveyed and dumped into sluice boxes, or by moving it directly to sluice boxes with scrapers. In the latter case a common plow is generally used for loosening the gravel.

Gravel deeper than about 20 ft. can usually be worked more cheaply by drifting than by open-cut methods, especially if the gold is concentrated at or near bedrock, which is the rule in the parts of the district that I have been over.

The best clean-up I personally know of, last year, was on Discovery claim, Cleary creek. The amount of gold recovered from the gravel in three days by ten men was a little more than $22,000. I have heard of larger clean-ups and presume that the reports are true.

The methods generally in use could be improved, and costs could be materially reduced by the use of proper equipment. One reason why better equipment is not employed is because most of the ground is worked by leasers, or "laymen" as they are termed here, the amount of ground in each lease being small, from 100 to 500 ft. along the claim and, of course, extending to both side lines. The leasers in most cases are men with small capital; consequently they use only such equipment as is necessary. If they do find pay the amount of ground under lease is so small that expensive equipment is not justified. The locators of ground naturally desire a large number of leasers, for then the ground is prospected more quickly and the gold, if any, is recovered in less time.

A method of extracting gravel with some kind of mechanical device for digging and loading, instead of with pick and shovel, which is the universal practice, would, I believe, very materially reduce present costs. The average output per man with pick, shovel and wheelbarrow is about 9 cu.yd. delivered to the bucket at the shaft for a 10-hour shift. The Park automatic loader and conveyer, manufactured by the Railway Materials Company, Chicago, it is claimed, handles from 1 to 3 cu.yd. per minute. I saw one in operation at the Gunnison tunnel in Colorado and it certainly handled muck very rapidly. These machines do not require a track, and I think would be easily adapted for the work described. The lack of any kind of undercurrent or mercury in connection with the sluice boxes also tends to reduce the amount of gold recovered. The methods here described will, I think, apply in general throughout Alaska.

The cost of thawing ground, generally, is about 30 or 40c. per cu.yd. Some dredges claim to be handling thawed gravel for 10c., but I am inclined to think it will be nearer 20c. for general practice, except under favorable conditions, judging from what I have seen.

Dredging

With regard to dredging, the practice is much the same as in the United States; the costs, however, must be twice as high. Frozen gravel is the greatest obstacle in dredging. The short working seasons also hinders the work. But in spite of these unsatisfactory conditions, I believe there is a big field and many encouraging opportunities for dredging in Alaska. The many rivers and sloughs traverse thousands of miles of territory a large portion of which is known to be gold bearing. The numerous bars in the beds of the streams are never frozen and could be easily dredged if the quantity of gold justified the expenditure. In very few instances have they been prospected, and then as a rule only by the crude appliances of the average prospector, and not with a view to dredging.

Last summer I panned some of the bars near here and seldom failed to get colors although the gravel panned was taken from the surface to a depth of about 12 in. and from immediately beside the river when the water was low. In coming down the Yukon I noticed in a few places, sluice boxes or rockers on a few of the high bars. Prospecting for this character of dredging ground could best be carried on in the winter.

Prospecting with Machine Drills

Any type of drilling machine, such as the Keystone, Star, Dempster, Cyclone, Empire, or even a spring-pole drill operated by hand would be adaptable for this kind of work. Dempster drills could be set up on the ice which covers the rivers in winter and the work could thus be carried on much more rapidly and to better advantage than from a scow. They may be moved from place to place quickly. There are a few of these drills here in use for prospecting the gravels. They do not require any casing when drilling in solidly frozen ground.

The greater part of the overburden is a very fine sand, and in this the drills make as high as 75 ft. in a day of 10 hours. In the gravel it ranges from 5 to 20 ft. per day. Work is carried on all winter These machines complete weigh 2 or 3 tons and are cumbersome to move for the country is generally covered with "nigger heads" (hillocks or big bunches of grass) and is practically impassable for any kind of vehicle. For inaccessible country except where roads are built, the Empire drill is best and cheapest; also for prospecting gravels not more than 100 ft. deep. The heavier sizes weigh about 1600 lb. and the lighter ones (for gravels up to 50 ft. deep), about 1000 lb. They can be taken apart and made into packs of 75 lb. The machine can be operated by hand or by horse or steam power. The others named cannot be operated except by steam, or gasolene.

The Spring-pole Drill

I have not seen or heard of the use of a spring-pole drill in Alaska although drills of this kind are frequently used in the United States. The spring-pole drill consists of a piece of drill steel, usually about 2½ or 3 in. in diameter of bit weighing about 150 lb. and fastened by means of a rope to the end of a pole which sustains the weight. One man, by pulling down on the rope, allows the bit to strike the ground, thus gradually cutting and disintegrating it so that it can be taken out by means of a sand pump.

An outfit of this kind does not weigh more than 350 lb. and can be operated to advantage to a depth of 50 ft. if not deeper. Such a machine would be invaluable to the prospector here providing he had a fair knowledge of drilling with any of the power machines named. It would permit of his prospecting ground where living water is encountered, which is impossible with the equipment of the ordinary prospector in Alaska. Living water has been encountered in some parts of practically every camp that I have heard of in Alaska. Such gravels, the conditions being favorable, could be dredged at good profit.

Investigations along this line will I believe result in the installation and operation of many dredges throughout interior Alaska. The type and size of the dredges to be employed will be governed by conditions. A small dredge with an estimated capacity of 500 cu.yd. per 24 hours was constructed at Fairbanks last fall at a cost of about $6000. The machinery was made by the Byron Jackson Company, of San Francisco, and consists essentially of a digging wheel which discharges through bottomless buckets into a 6-in. suction pipe connected with a centrifugal pump mounted on a barge at water level. Gasolene power is used for operating it; the requirement being 16 h.p. It was in operation for a day or so and it is claimed, worked satisfactorily.

A knowledge and the careful consideration of existing conditions is essential to the successful construction and operation of dredges in Alaska. This has been thoroughly demonstrated by the many unsuccessful installations on Seward peninsula. There are dredges now operating successfully and at a profit on Seward peninsula, however, and the successful ones are not all of the same type either. I have heard of dredging ground in the Forty Mile district southeast of Fairbanks upon which some dredges are operating. I understand there is also good

ground for dredging northeast of Fairbanks, in the Birch Creek district near Circle on the Yukon. Mr. Barnette, a banker and mining operator of Fairbanks, has invested rather heavily in the Birch Creek district this fall and winter and has a drill of the Keystone type prospecting ground with a view to dredging. One hears of ground in almost any of the districts that may possibly be suitable for dredging.

Winter Prospecting

In Alaska the greatest amount of prospecting is done in the winter. A large proportion of the prospectors work in the mines in the summer and prospect in the winter. They travel over the frozen streams in winter with sleds. In the summer poling boats are used, long boats of the canoe type, pushed along by means of a pole. In going down stream nothing is needed except an oar, with which to guide the boat.

Ice begins breaking up about the first or middle of May, and in a few days after the ice begins to break up the rivers are clear. Summer advances rapidly after the ice goes out. Mush ice begins to run in the rivers about Oct. 15 or 25, and in a week or two the rivers are frozen over. There are usually no frosts until about the first or the middle of September. Many vegetables are raised in Alaska. Potatoes raised in the territory sold for 10c. per lb. last fall. Tomatoes, celery, carrots, turnips, etc., were also on the market.

Prospecting by Means of Shafts

Sometimes the thawing of the ground is accomplished by means of a wood fire, or with rocks heated and thrown down the shaft and covered with moss. When this method is employed several holes are usually thawed simultaneously. The method is very slow, from a few inches to as much as a foot in depth being thawed in a day. The more common device is the steam point, the usual prospector's outfit consisting of a small boiler weighing about 250 lb. and costing about $250. A couple of points with ½-in. pipe and a short length of steam hose, picks, shovels, etc., complete the equipment. Hoisting is usually done by hand. The complete outfit, including provisions for a season, can usually be loaded in a poling boat and handled by two men.

In winter prospectors frequently use dog teams if game is plentiful in the districts to be prospected. Otherwise they are too expensive to keep. As a rule it is not necessary to timber prospect shafts. When water is encountered, work is usually abandoned even though the prospect is fairly good, which is frequently the case.

The common method in Alaska for estimating values is by the quantity per pan, from five to seven pans being reckoned as a cubic foot.

Placer claims are usually staked 660x 1320 ft. except in association claims which consists of 160 acres.

Regarding the prospecting of wet gravels, I have seen but one drilling machine equipped with casing which is necessary in order to drill ground of this character, and this machine was owned by Mr. Barnette and was on the way to the Birch Creek district for the purpose of prospecting shallow dredging ground. Drilling machines in the neighborhood of Fairbanks abandon the hole when they strike thawed gravel, for the loose ground caves in, and attempts to drill without casing nearly always results in the loss of a string of tools, which are very expensive and hard to replace. The hole drilled by most machines is 6 in. in diameter, although 4 in. is sometimes used.

An outfit, including a season's provisions and a spring-pole drill which can be operated by one man, will cost in the neighborhood of $1500. One thousand dollars a year would about cover expenses. A larger allowance would permit of visiting a greater number of districts traveling by regular passenger boats operated by the transportation companies, and this might be best if securing property by bond and option were considered of the first importance.

Experiences in the Koyukuk District

Since beginning this letter I have had an interview with a man who has just arrived from the Koyukuk district. He had been in that section three or four years and brought out $3000 or $4000 in gold dust. He said the best find so far made is on Olson's claim, Nolan creek, at a depth of 140 ft. and on bedrock. Three men took out $125,000 above expenses in about three months, one pan taken from in front of a ridge in bedrock being worth $1500. Two claims above this on the same creek $65,000 was taken out in the season, but the gold came mostly from gravel to a depth of 12 or 15 ft. from surface. He does not think they reached bedrock at all.

In one place in which he worked on Emma creek, eight miles above Nolan creek, they drifted in on good pay gravel until they struck a hard cemented conglomerate which they could not work although they used some powder. He said they could see some gold in the conglomerate. He also stated that they sometimes found in the sluice boxes gold entirely covered with a white crust or coating, probably carbonate of lime. He stated that bedrock was sometimes limestone, but more generally a schist.

The gulches were frequently narrow and steep. They worked on lease in one place where they shoveled gravel as deep as 3 ft. below water, never reaching bedrock except in a few places; the gravel produced good pay. There is very little machinery of any kind in the district, the transportation companies claiming that they could not get shipments in during the fall. He stated that wet ground on one or two creeks that he had panned prospected well, but that the gravel was probably deep and would be expensive to pump; it might be dredged, but he knew nothing of dredging methods.

There were no drilling machines of any type in the country. The number of men in the district was about 200. To anyone with little money he would recommend the country as a good prospecting field. He said that he got $18.20 per oz. for his gold at the bank after paying a 2½-per cent. fee for exchange or purchase, which is charged by all banks in Fairbanks, when purchasing gold dust. The Olson strike, was described in the Seattle papers in July, 1908, on the arrival of an Episcopal minister from the Koyukuk. The gold from this district is coarse.

Opportunities in the Interior of Alaska

To those who will work and have a knowledge of how to do so intelligently and who are not afraid of some hardships, Alaska offers many inducements, one in particular being the prospecting of wet gravels. This, I believe, can readily be done with drills of almost any type. A determination of the gold content and depth and a rough estimate of the flow of water would indicate whether the ground could be worked profitably by dredging or otherwise.

The cost of a machine drill is about $2500, and an equipment of this kind is expensive to operate and move except for very short distances, as for instance from one hole to another on a 20-acre claim. Engineers' wages are $7 per day and board, and of helpers, $5 a day and board. Wood and water must usually be hauled and this requires the services of another man and sometimes a horse for a portion of the time. With a spring-pole drill there would be no additional expense above those necessary with present methods. Of course a spring-pole drill will not drill nearly so fast as a machine but it requires much less time to move, set up and take down. A spring pole can usually be cut where the hole is to be drilled. Wet gravels can be prospected if casing is used, as readily as with machines.

In making concrete mortar-block (C. E. Parsons, *Bull. No. 50* I. M. and M.) the concrete should be well tamped as well as thoroughly mixed, and if possible all the cement should be put in place in one day. Generally the proportion of cement is increased near the top of the block.

In Austrian mines, according to the *New Zealand Mines Record,* underground rescue chambers are provided. These are made to hold 50 men, and besides having pure oxygen piped into them, are stocked with provisions, first-aid supplies and rescue apparatus.

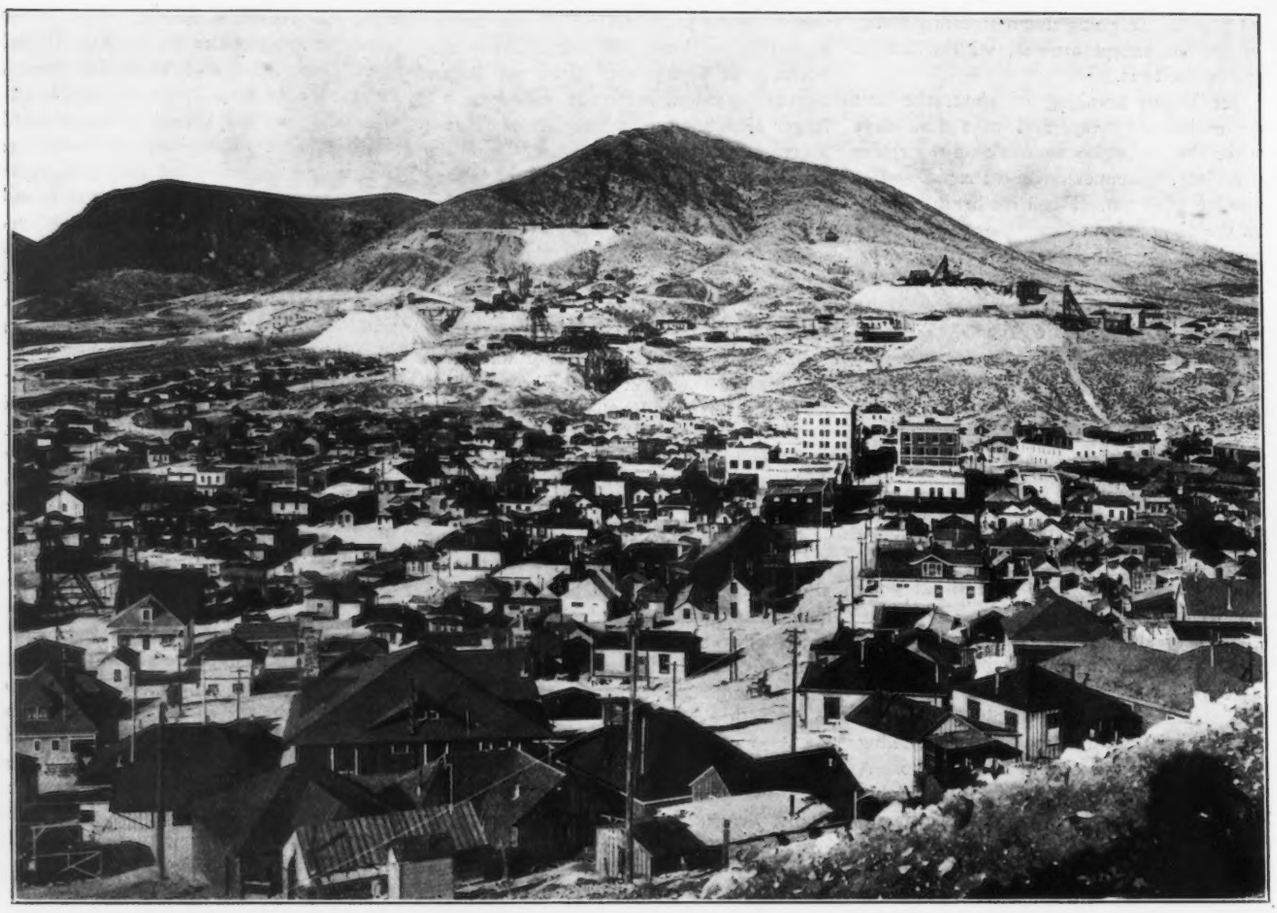
The Mines and Mills of Tonopah, Nevada

The Gold-Silver Mines Have Been Handicapped by Lack of Transportation; Cyanide Mills Now Treat the Low-Grade Ores

BY G. E. WOLCOTT*

In the last few years the Tonopah mining district has been rapidly taking a place of importance among the silver-producing camps of the United States. Recent strikes in the camp promise a steady and probably increased production. The principal producing properties of the district are, in the order of tonnage produced, as follows: The Tonopah Mining Company, the Montana-Tonopah Mining Company, the Tonopah-Belmont Mining and Development Company, the MacNamara Mining Company, the Midway Company and the Tonopah Extenion. The Jim Butler, West End and North Star mines have been rather intermittent producers. The approximate total monthly production is at present about 25,000 tons with an estimated value of more than $500,000.

Until within the last few years only ore of a comparatively high grade could be mined at a profit, but with the completion of the milling plants at Millers of the Belmont and Tonopah companies and that of the Montana-Tonopah at Tonopah ore of much lower grade can be worked. The town of Millers is situated on gently sloping ground 11 miles from the mining center. Water is obtained in ample quantities for milling purposes at a depth of about 35 ft. and is pumped to the mills from plants situated a short distance below them.



TONOPAH FROM BROUGHER HILL

Methods of Mining

None of the Tonopah mines has been troubled with water, although the deeper shafts have reached a depth of 1200 ft. and more. The Mizpah shaft of the Tonopah Mining Company is at present being sunk to a greater depth than has hitherto been reached.

Overhead stoping is the rule, the machines mostly in use being of the air-hammer type, which have here almost entirely replaced piston machines for overhead work. Piston machines, 2½ in., are mostly used for drifting and sinking. The ore consists chiefly of quartz carrying only a small percentage of sulphides, with the silver mostly in the form of proustite and pyrargyrite. The proportion of silver to gold is about 100 to 1 by weight or 5 to 2 in value. A part of the ore requires very little sorting, and some is milled without any sorting at all; the proportion of waste rock in the ore is usually comparatively small. Veins vary in width from a few inches to as much as 30 ft. or more, and are usually only slightly inclined from the vertical.

The Tonopah Extension is the only mine which is shipping any amount of ore to outside points. The ore as milled has

*Mining engineer, Ione, Cal.

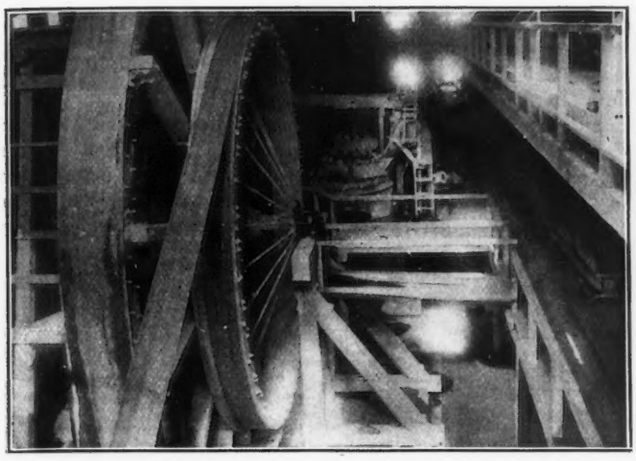
an average grade of from $20 to $25. All of the principal producers of the camp are situated in the saddle between Oddie and Brougher hills and upon the sides of these hills.

Milling

The mills of the district include the Belmont mill, having 60 stamps; the Desert mill of the Tonopah company, 100 stamps, and the Montana-Tonopah with 40 stamps. These three mills are treating in the aggregate about 24,200 tons per month, the tonnage being divided as follows: The Desert mill, 1350; Belmont, 6000; Montana-Tonopah, 4700. Assuming an average grade of $22 and an extraction of 90 per cent., this gives a yearly production of $5,749,200.

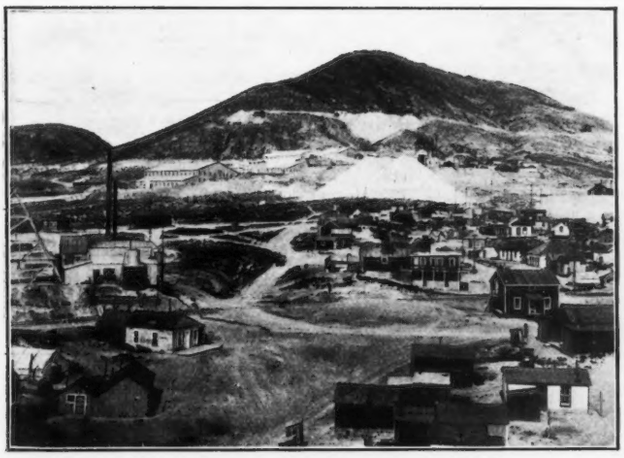
The Montana-Tonopah mill has recently been described. This plant is situated at the company's mine on a side-hill site, and less power is required for elevating purposes than at either of the other two mills. The plant is well constructed throughout and has been treating ore at an average cost of less than $4 per ton.

The Belmont mill was first constructed to use Huntington mills following the stamps; but at present these are not in use, the entire crushing being done by stamps. The batteries crush through a 35-mesh screen and run in units of 20 stamps, driven by 50-h.p. electric motors. The stamps are arranged so that 10 stamps can be started at a time. The same arrangement is used at the Desert mill. The flow sheet of this mill is much more complicated than that of the Belmont or the Montana-Tonopah mills. The essential difference between this mill and the Belmont is that stage grinding is employed by the use of Huntington



SAND WHEEL, DESERT MILL

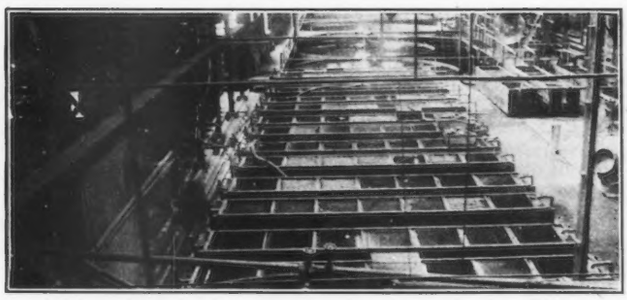
LEACHING TANKS, DESERT MILL



MINE AND MILL, MONTANA-TONOPAH COMPANY

DESERT MILL, MILLERS, NEVADA

BELMONT MILL, MILLERS



ZINC BOXES AND CIRCULATION TANKS, DESERT MILL

mills following the stamps. The stamps crush to 10 and 12 mesh, and the Huntingtons to 30 mesh. The middlings from the Wilfley tables are also reground in a Huntington mill. With the exception of this feature the practice is essentially the same as at the Belmont plant.

At the Belmont mill the crushing is done in a solution containing 45 lb. cyanide per ton. In the sand-leaching tanks 300 lb. additional cyanide is used for 140 tons of ore, and in the slime-agitation tanks, 300 lb. for 80 tons of ore. The total cyanide consumption is 3.2 lb. per ton. To prevent the reprecipitation of silver in the form of sulphide, ¾ lb. lead acetate is added for each ton of ore; at the Desert mill 1 lb. is used for three tons of ore in the sand tanks, and 1 lb. for each ton in the slime tanks. The sands are first collected in dewatering tanks, where they are drained by means of a suction pump and then transferred by belt conveyers to the leaching tanks.

The treatment in the leaching tanks occupies 14 days. At the Desert mill a Blaisdell excavator is used for emptying tanks, while hand labor is employed at the Belmont. In each case the tanks are emptied by center-discharge gates upon belt conveyers.

Slime Treatment

The slimes are agitated by mechanical agitators for a period of 72 hours, steam and compressed air being admitted at the bottom of the tanks for heating and oxidizing. It is aimed to heat the pulp to about 90 deg. and steam is generated especially for this purpose. A lowering of temperature results in decreased extraction. Sands and slimes are produced in the proportion of 55 to 45.

From the slime-storage tank the slimes go to two Butters filter tanks containing 60 leaves each, the filters being 5x10 ft. The original filters had a filtering medium consisting of cocoa matting inside heavy filtering cloth. These proved unsatisfactory because of the clogging of the matting by lime, and are being replaced by homemade filters using the original frames. Instead of cocoa matting, wooden strips, ½ in. square and placed 2 in. apart, are used. These give better satisfaction than the original leaves and give a greater filtering capacity.

The treatment in the filter vats takes a little more than three hours. Slimes are introduced for about 1¼ hours; the pulp is then pumped back to the storage tanks, the cake being held on the leaves; and weak cyanide solution is drawn through about one hour. The time taken in charging, discharging, etc., brings the total up to more than three hours. The filters are given a treatment in dilute hydrochloric acid every 15 days, separate tanks being provided for the treatment. The filters are also tested to detect and repair any leaks that may develop.

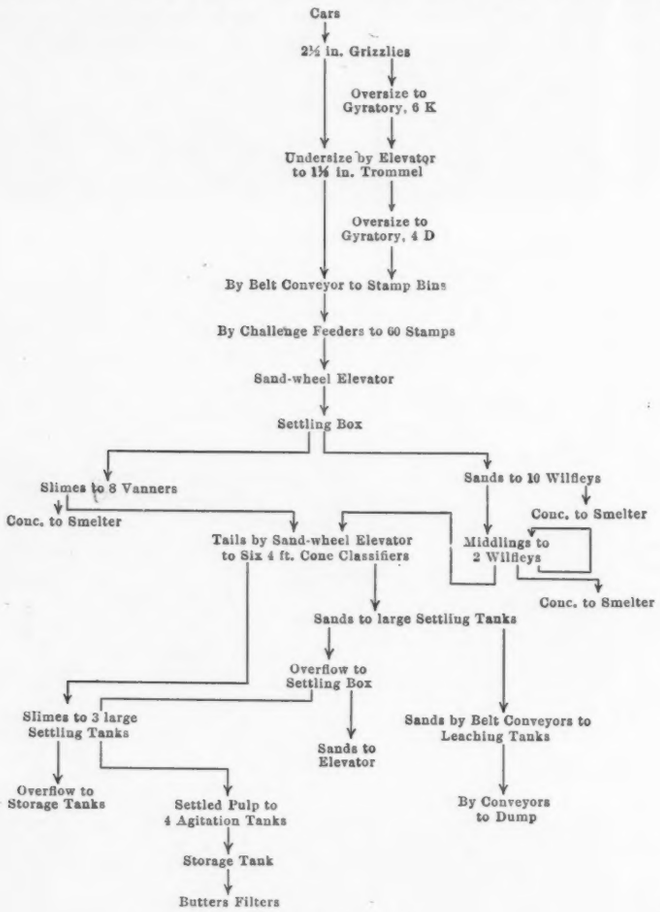
Precipitation at both the Belmont and the Desert mills is by zinc shavings cut at the plant. The zinc precipitates are dried and melted direct, without any preliminary acid treatment. At the Montana-Tonopah mill precipitation is by means of zinc dust, the precipitates being sent to the smelter.

Concentration and Costs

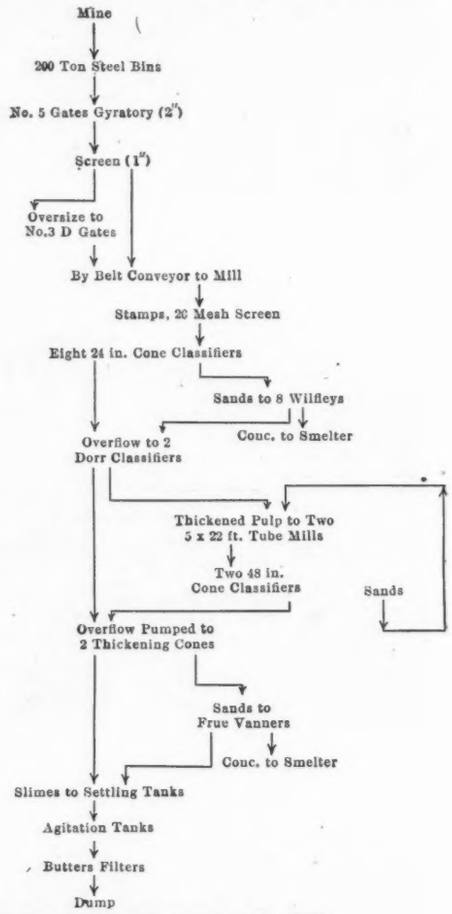
In the concentrating department one ton of concentrates is obtained from 100 tons of ore, the concentrates carrying an average of 600 to 700 oz. silver and about 8 oz. gold. No attempt is made at any of the mills to treat their own concentrates, although some experimental work has been done with this end in view.

At all three of the mills a bullion recovery of approximately 90 per cent. of both silver and gold is claimed.

At the Belmont mill the cost of treatment for the year 1907 was given as $7.825 per ton. While authoritative figures could not be obtained at the time of my visit, this figure is generally supposed to be higher than the actual cost. The Belmont and Desert mills at first generated their own power by steam at a rather excessive cost. This has since been greatly lowered by the use of power


Cars
2½ in. Grizzlies
Oversize to Gyratory, 6 K
Undersize by Elevator to 1½ in. Trommel
Oversize to Gyratory, 4 D
By Belt Conveyor to Stamp Bins
By Challenge Feeders to 60 Stamps
Sand-wheel Elevator
Settling Box
Slimes to 8 Vanners
Conc. to Smelter
Sands to 10 Wilfleys
Conc. to Smelter
Tails by Sand-wheel Elevator to Six 4 ft. Conc Classifiers
Middlings to 2 Wilfleys
Conc. to Smelter
Sands to large Settling Tanks
Overflow to Settling Box
Slimes to 3 large Settling Tanks
Sands to Elevator
Sands by Belt Conveyors to Leaching Tanks
Overflow to Storage Tanks
Settled Pulp to 4 Agitation Tanks
By Conveyors to Dump
Storage Tank
Butters Filters

FLOW SHEET, BELMONT MILL



FLOW SHEET, MONTANA-TONOPAH MILL

generated near Bishop, Cal., and supplied at the mills at a rate of from $11 to $12 per horsepower-month.

At the Belmont mill the crushing is in one operation with subsequent separation of sands and slimes; at the Desert mill stage grinding, with Huntington mills following stamps and separation of sands and slimes, is used, while at the Montana-Tonopah entire sliming of the product with the use of tube mills is practiced. It would be interesting to compare the milling costs in the three cases, but at present sufficient data are not available.

Short Talks on Mining Law—XIII

By A. H. Ricketts*

A patent for land claimed and located for valuable deposits may be obtained by any person authorized by law to locate a mining claim and who may have complied with the terms of the mining act. That act provides what steps are necessary, and the Land Department may be said to regulate the proceedings for, and to finally determine the right to the patent.

The Land Department (including in that term the secretary of the interior, the commissioner of the General Land Office and their subordinate officers) constitutes a special tribunal, vested with judicial power to hear and determine the claims of all parties to the public lands which it is authorized to dispose of, and also the power to make conveyance of the government to the parties it declares are entitled to it.

The manner for obtaining a patent for either a lode or placer claim, whether for a single claim or for a number of contiguous lode or placer claims, that is, those which touch sides, lie alongside of, are adjacent or adjoin, with or without a mill site included therein, or for a mill site only, is substantially similar, except that all lode claims and mill sites must be officially surveyed for patent; and that coal lands can be entered only after survey and by legal subdivisions under special regulations. But one entry of coal or saline lands and possibly of a mill site by any person, association of persons, or a corporation, is allowed by law. Placer claims which have not been located according to the rectangular subdivisions of the public surveys must be officially surveyed. Claims which constitute one or more contiguous 10-acre lots of a 40-acre tract, may be subdivided into squares with lines at right angles with the lines of such surveys, and can be appropriately described as, say, the northeast quarter of the northeast quarter of the northeast quarter of a certain section, range and meridian, are not subject to such survey. If the claim be all placer ground, that fact must be stated in the application for patent and be corroborated by the affidavit of other persons. If of mixed placers and lodes, it should be so set out, with a description of all known lodes situated within the boundaries of the placer claim. Known veins or lodes included within such area must, if claimed by the applicant, be specifically applied for, or his right thereto will be waived. Where an official survey of a placer claim is made, the Land Department requires the deputy making the survey, to file a verified, corroborated report, containing such data as, for example, the proximity of the claim, the centers of trade or residence, the amount of vegetation, the *locus* and size of streams, etc. Such report must be made a part of the application for patent, or as oddly expressed in the rules of that department, be "included in the oath of the applicant."

Applications for Patent—the Survey

The initial step in an application for either a lode or a mill site, or both combined, is the filing with the United States surveyor general of the district in which the same may be situated, of a written application, requesting an official survey of the claim by a deputy United States mineral surveyor, nominated therein by the applicant, who has no interest in the claim and whose charges must be paid for by the latter. The courts are not in accord as to whether the deputy is the agent of the applicant or not. Contemporaneously with the application there should be filed therewith a copy of the location notice certified by the officer in charge of the records where the same is recorded, or a statement showing sufficient reasons for its absence. Also a certificate of deposit, issued by the proper United States subtreasurer for the amount which may be required by the surveyor general in the preparation of the plat and field notes of the survey in his office. Thereupon such deputy receives an order of survey from such officer. The survey should be actual, and should be made in conformity to the rules of the Land Department, of which the surveyor-general's office is an integral part. When making the survey the end lines of the location may be straightened within the boundary lines of the claim. Errors in the survey occurring through the carelessness or negligence of the deputy, must be corrected by him at his own expense. His failure to comply with instructions from the department to do so within a specified time is ground for his suspension or removal from office.

The deputy is required to transmit to the Surveyor General his field-notes, a preliminary plat of the survey, indorsed with his approval, together with a statement of the value of the labor done or improvements made upon the claim, or if done upon one of a group of contiguous claims, that the work so done or the improvements made tend to the development of all the claims within the group and equals in the aggregate the statutory expenditure of $500 upon each of them. These data are retained in the office of the surveyor general, who, if the same are correct, approves thereof and causes copies of the same to be made in his office and sends to the applicant copies of the plat for posting upon the property, and also for filing in the local land office, together with the field-notes, as a part of the application for patent. This officer also sends a copy of the plat to the general land office at Washington and another copy to the local land office. It is usual for him to certify upon the plat that the statutory amount necessary to obtain a patent has been expended upon the claim (not upon the mill site). But this is not essential as such an expenditure may be made after survey and before the expiration of the period of newspaper publication and the certificate filed thereafter. This certificate of expenditure may be attacked in the land department before patent issues. Otherwise, it is conclusive of the facts stated therein. The equivalent of this certificate is an affidavit, where the application is for a placer claim which is not subject to official survey, made by two or more disinterested witnesses that not less than $500 has been expended by the applicant or his grantors upon the claim, located by legal subdivision.

The next step in the proceeding is for the applicant to post a copy of the plat in a conspicuous place upon the claim and also one upon the mill site, if the application includes such, together with a notice of intention to apply for a patent. Both must be posted in such a way that they can be readily examined by any person desiring to do so. This posting must be done in the presence of two credible witnesses, who must make affidavit of such posting. This affidavit, which should state the date and place of posting, and contain a copy of the notice posted must be filed with, or before, the application for patent is filed.

Proceedings in the Local Land Office

What may be termed the "application papers," and which should be filed say, contemporaneously in the proper land office, consist of the following documents:

1. The said affidavit of posting the plat and notice upon the claim.

2. An application under oath of the claimant, or his attorney in fact or agent thereunto duly authorized, which should show, as clearly as possible, the facts constituting compliance with the requirements of the law, the origin of possession and the basis of the claim for the patent. If the application is for saline lands there must be incorporated in the application a statement that the applicant has never, either as an individual or as a member of an association, located, applied for, entered or held any other saline lands. If the party applying for patent does so as a trustee, he must fully disclose the nature

*Member of the San Francisco Bar.

of the trust, the names of his trustors, and furnish satisfactory proof of the citizenship of himself and of them.

3. Evidence of the citizenship of the applicant, which, if a natural person, should be given by his affidavit; if an association of persons, by the affidavit of each of them or of an authorized agent or attorney in fact made upon his information, or upon his information and belief; or if a corporation, by a certified copy of its articles of incorporation.

4. A duly authenticated copy of the authority of the attorney in fact or agent to apply for the patent, which in case of an individual or association may be by letter of attorney, or if the claimant be a corporation, by a copy of the resolution appointing him for that purpose, taken from the minutes of the meeting of the directors of the corporation, at which he was appointed, and certified to as correct by its secretary, under the seal of the corporation.

5. A copy of said plat and field-notes given by the surveyor general to the claimant.

6. A duly certified copy of the location notice and an abstract of title of the property complete to the time of filing the application, certified by the custodian of the records, or by a duly authorized searcher of records, or an abstract maker, who must certify that no conveyances affecting the title of the claim appear of record, other than these set forth in the abstract. The abstract may be in the usual form of such a document. That is to say, instruments usually abbreviated in such a work, may be abbreviated therein.

Other Requirements

In the event that the records may have been destroyed, an affidavit by the claimant, supported by the affidavit of any other person cognizant of the facts relative to the location, occupancy, possession, etc., should be filed with the application. When an applicant bases his right to a patent upon the statute of limitations, he is not required to file any evidence of location, copies of conveyances, or abstracts of title, as in other cases; but he is required to furnish a duly certified copy of the statute of limitations affecting mining claims in the State or Territory within which the claim may be situated, together with his affidavit, giving a clear and succinct narration of the facts as to the origin of his title, and likewise as to the continuance of his possession of the ground covered by his application; the area of his claim, the nature and extent of the mining that has been done thereon, whether there has been any opposition to his possession or litigation with regard to his claim, and if so, when the same ceased; whether such cessation was caused by compromise or by judicial decree, and any additional fact within the claimant's knowledge having a direct bearing upon his possession, and *bona fides*, which he may desire to submit in support of his claim. Thereafter the proceedings are the same as in other cases, excepting that the statement of facts as to the origin of the title of the applicant must be corroborated by the affidavit of one or more disinterested persons.

If the locators are the applicants for patent, they should state in their application, if such be the fact, that they have disposed of no interest in the claim.

Transfers made after the filing of the application will not be considered, but patent will issue in the name of the applicant, except when he is defeated in an adverse suit, or the protest of a co-owner may be sustained; but where the applicant is known to be dead prior to the submission of the final proofs and payment for the land, the register's duplicate receipt will issue in the name of the applicant's heirs and patent issued in conformity thereto.

Generally, all affidavits required in these proceedings may be verified before any officer authorized to administer oaths within the land district wherein the claim may be situated, as, for instance, a notary public within the county for which he is appointed, whether such county is wholly or partly without such district. In coal-land applications each application, declaratory statement and affidavit must be verified before the register or receiver in the land district wherein the lands involved are situated. All affidavits made outside the proper land district are insufficient and proceedings based thereon are void and patent cannot be obtained thereon. The exceptions to the rule are, that where the applicant resides or the adverse claimant resides, or at any time being beyond the limits of the district wherein the claim is situated, he may make any oath or affidavit required for proof of citizenship or to the adverse claim before the clerk of any court of record, or before any notary public of such State or Territory.

7. An agreement of the publisher to hold the applicant for patent alone responsible for charges of publication of notice.

8. A notice for publication and one for posting in the local land office, embracing all the data given in the notice posted upon the claim and indicating the *locus* of the claim by giving the connecting line, as shown on the field notes and plat between a corner of the claim and a United States mineral monument or corner of the public survey. Also stating the boundary of the claim by courses and distances, and the names of the bounding claims, if any. If this notice is declared insufficient by the land department, the application is defective, and the proceedings from that point must be commenced anew.

Where the application embraces a mill site there must also be filed an affidavit of two or more persons capable from acquaintance with the land to testify understandingly of its non-mineral character.

If no reason appears to the local land officers for rejecting the application the register orders publication of notice of such application for 60 days in a newspaper published nearest to the claim. The time for filing an adverse claim is not enlarged by the fact of excessive newspaper publication, nor by stipulation between the parties. During the period of publication, the plat and notice must remain posted on the claim, and during the same period the register must keep a copy of the notice posted in the land office.

If the application should be rejected by the local land officers, they must give their reasons therefor, and allow the applicant 30 days for an appeal to the commissioner of the General Land Office at Washington, from whom an appeal lies to the secretary of the interior.

If no adverse claim is filed, the applicant, after the said period of newspaper publication, or after the adverse claim is determined if one be filed, must within a reasonable time thereafter file the following additional papers:

9. Affidavit of the publisher that the said notice was published for the statutory period.

10. Affidavit of the claimant, that both the said plat and notice remained conspicuously posted upon the claim during the period of such publication.

11. Affidavit of the claimant showing what fees and charges were paid to the register and receiver, to the deputy for the survey of the claim for publication of the notice, and for the land embraced in the claim.

12. Written application for purchase from the Government of the property, accompanied by a sum equal to $5 an acre, and each fractional part thereof, for a lode claim and mill site, or for a known lode within a placer claim and $2.50 for each acre and each fractional part thereof embraced within a placer claim.

Thereupon the receiver of the land office issues a "duplicate receipt" to the applicant therefor. This instrument is sometimes called "final receipt," or "certificate of purchase." After its issuance further annual expenditure on the claim is not required, unless such receipt may have been procured by fraud.

When Proceedings are Suspended

The patent proceedings may possibly be interrupted by the filing of an adverse claim or a protest. The difference between an adverse claim, which is provided for by the mining act, and a protest, which is provided for by the rules of the Land Department, is that the first named must be filed within the 60-days' period of newspaper publication by one, or the heirs of one having a direct interest, or some right in the land, or some part of it, adverse to the applicant, and must be followed by an action commenced in a court of competent jurisdiction within 30 days thereafter; whereas a protest may be filed at any time before the actual

issuance of the patent by a person who appears as a friend of the Government in the proceedings, or in aid of the establishment of his equitable right in the premises. The grounds of a protest may be the non-citizenship of the applicant, or some fraud, lack of good faith, or failure on his part, in regard to any of the essential requisites to entitle him to a patent; or that the protestant is a claimant of a present interest and is surreptitiously excluded by the applicant from the application for patent. In the latter case, if suit is brought, the Land Department delays the issuance of patent until the courts have determined the rights of the respective parties, although there is nothing in the law requiring it to do so, and ordinarily proceedings on a protest are confined to the Land Department without right of appeal in the absence of a present interest.

By the terms of the mining act, the filing of the adverse claim suspends all proceedings in the Land Department, except the publication and posting of the plat and notice upon the claim and the filing of proof of each thereof, until the adverse claim is finally determined by the court, or is adjusted between the parties thereto, or the same is waived.

Waiver may be evidenced by a failure to commence suit within the statutory time, or by filing in the records of the court a statement or stipulation of the plaintiff that he abandons his case, or waives his claims, or by an instrument, signed by him and duly authenticated, stating that he has sold his interest to the other party, or by his failure to appear at the trial. Where an adverse claim has been filed, but no suit commenced against the applicant for patent within the statutory period, a certificate to that effect by the clerk of the State court having jurisdiction in the case, and also by the clerk of the Circuit Court of the United States for the district in which the claim is situated, are required by the Land Department. If suit has been commenced upon the adverse claim, a relinquishment, or other evidence of abandonment of the adverse claim will not be accepted by the Land Department, but the case must be terminated and proof thereof furnished by a certificate of the clerk of the court, to that effect, or by a certified copy of the judgment roll.

The applicant for patent waives his right thereto by failing to prosecute his application to completion by filing the necessary proofs and making payment for the land within a reasonable time after the expiration of the period of publication of notice of the application, or after the termination of the adverse proceedings.

The Adverse Claim

An adverse claim is limited to the determination of surface conflicts arising from independent conflicting locations of the same ground by adverse mineral claimants, or between a mineral claimant and the owner of a mill site, or possibly where the same land may be claimed under different laws, as for example, the owner of a town lot may adverse an application for a mining claim. It does not extend to controversies between co-owners claiming under the same location or title.

An adverse right is lost if not made the subject of an adverse claim, and the latter is nullified if not followed by suit commenced and prosecuted with due diligence. An adverse right cannot be the subject of a protest or *vice versa*.

The courts have specifically found that the following holders of rights in a mining claim are not compelled to file an adverse claim to protect their respective rights: Co-owners, easement-holders, lienholders, a mining claimant as against an application for a town-site patent, the owner of a known lode against an application for a placer patent not including such lode therein, a senior patentee, and in some cases a tunnel claimant.

The adverse claim must be upon oath of the adverse claimant, or his or its duly authorized agent or attorney in fact, cognizant of the facts stated. It must show the nature, boundaries and extent of the adverse claim and be followed by suit brought within the statutory period and prosecuted to final judgment unless otherwise disposed of.

The nature, boundaries and extent of the adverse claims are shown by the filing in the local land office of the following papers:

1. A plat showing the adverse claimant's entire claim, its relative situation or position with the one against which he claims and the extent of the conflict, except that when both claims are claimed by legal subdivisions, no survey or plat is necessary. If not so held it is preferable to have such plat made from an actual survey by a deputy mineral surveyor and its correctness officially certified thereon by him, but this is not essential, nor does the matter have to pass through the surveyor general's office.

2. An affidavit fully setting forth the nature and extent of the interference or conflict and whether the party claims as a purchaser for a valuable consideration or as a locator. If the transaction was a verbal one, the circumstances attending the purchase, the date thereof, and the amount paid are to be stated. This should be corroborated by the affidavit of one or more witnesses, if any were presented at the time.

3. A duly certified copy of the location notice from the office of the proper county recorder.

4. A duly certified copy of the conveyance to the adverse claimant, or an abstract of title, as in the case of an application for patent.

5. If the "adverse" is filed by an agent or attorney in fact proof of his authority, as in the case of an application for patent.

Upon the filing of these documents and the payment of the requisite fee, the officers of the local land office give notice of such filing to both parties and that it is necessary for the adverse claimant to bring suit thereon within 30 days after such filing, to determine the right of possession to the land in dispute.

The adverse suit may result in a judgment for none of the parties thereto, or in a judgment in favor of the plaintiff or of the defendant, or there may be as many different judgments affecting different parts of the claim as there are successful parties to the litigation.

To complete the patent proceedings the successful party to the litigation is required to file in the local land office a duly certified copy of the judgment roll, except that where such suit has been dismissed a certificate of the clerk of the court to that effect or a certified copy of the order of dismissal will be sufficient, together with the proofs required where no adverse claim has been filed. In case he be an adverse claimant, he must also file therein:

1. A certificate of the surveyor general that the requisite amount of labor has been done or improvements made and the description required in other cases.

2. A written application to purchase, and payment as set forth in No. 12 hereof.

Whereupon, a "duplicate receipt," or certificate of purchase is issued, provided the local land officers are satisfied that the proper proofs have been filed, in which event the whole proceedings and the judgment roll are certified by the register to the commissioner of the General Land Office, and patent issues to the claimant for the claim as applied for, or for such portions thereof as the applicant or the adverse claimant shall appear from the judgment of the court to possess rightfully. That is, patent issues to the respective parties, according to their respective rights, provided, that the officers of the General Land Office are satisfied that patent should issue at all, as the judgment of the court is conclusive only between the parties as to the right of possession and not as between them or any of them and the Government in the matter of the passage of the fee-simple title. Hence, the Land Department may require an amendment of the application or of some one or more of the papers comprising the same, or order a hearing in the local land office to determine the character of the land or order a segregation survey therof; or possibly it may cancel the certificate of purchase, and perhaps upon proper proceedings had, declare the land restored to the public domain. A subsisting "duplicate receipt," is equivalent as far as third parties are concerned. It is free from collateral attack.

Reclaiming the Inclined Hoistway at Mine 21

By Guy C. Stoltz*

Mine 21 at Mineville, N. Y., a magnetite property of the Port Henry Iron Ore Company, was at first (1846) worked on the outcrop by the room and pillar method the ore being hoisted on a double-track 57-deg. incline trestled throughout and following in general the dip of the footwall. As the workings became deeper, the management, in order to secure the approximately 35 per cent. of the deposit left in pillars and floors, decided to shoot down the roof and overlying burden of sand and boulders. This was done and an open pit was formed, extending out from the hoistway in a broad fan shape, to points where the burden, because of the dip, became too deep to shoot down and rehandle economically. This involved some very cheap mining. The ore and rock was hoisted by the double-track incline, and two Lidgerwood cableways. The low cost of extraction from the open pit was, however, offset by the annual expense incurred in handling the large volume of water, precipitated in the pit in the form of rain and snow.

After the larger pillars had been mined out, the pit method was abandoned, sinking was resumed and the mine was again worked on levels, room and pillar fashion, and a roof of ore was left to protect the workings from any possible slides from the faces of the open pit.

Falls from the Sides of the Pit

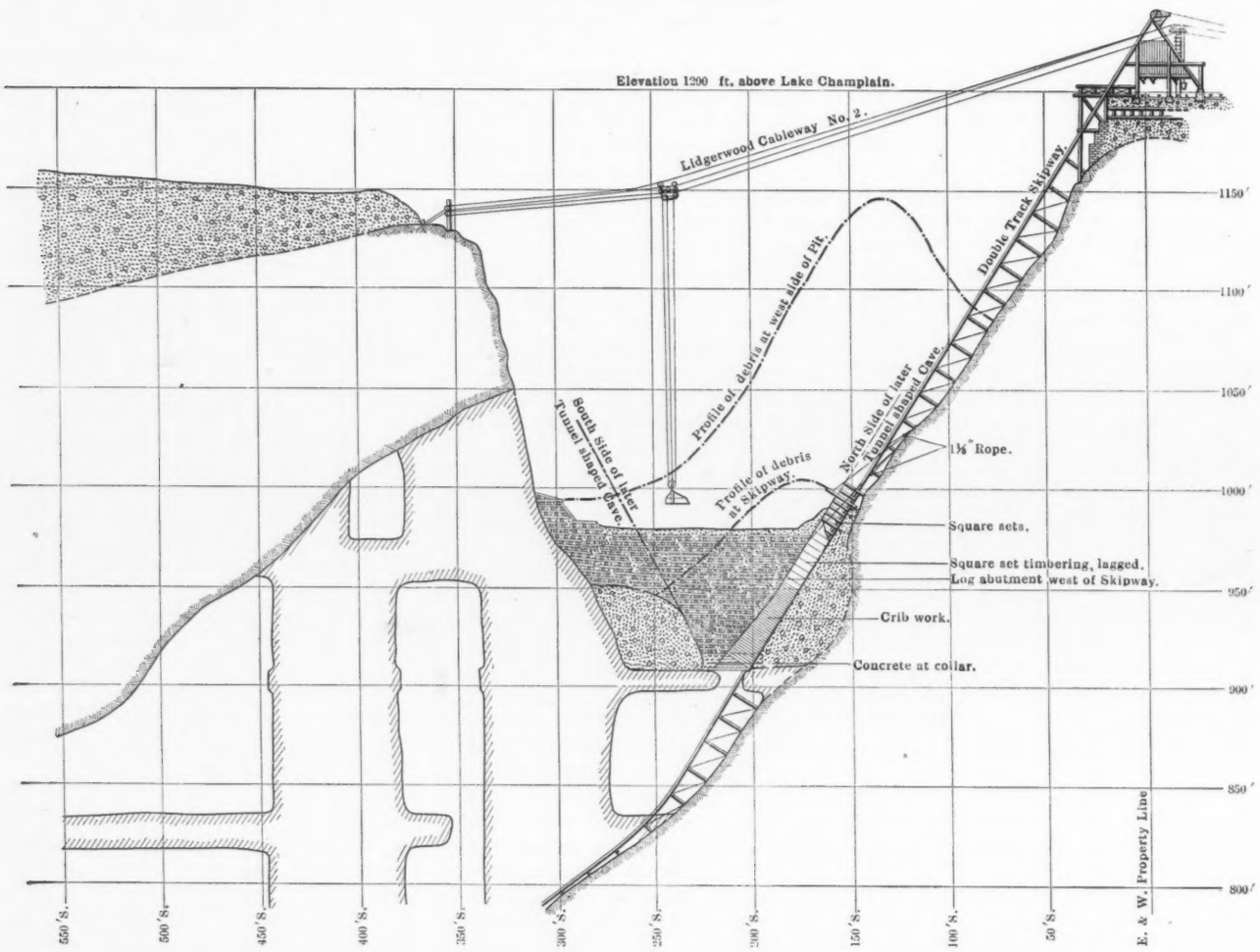
Soon water and atmospheric agencies began to act upon the gneissic footwall, and upon the pillars which were supporting a very seamy hanging wall, overlaid with drift and boulders. In February, 1905, one of the pillars gave away and one side of the pit fell about 300 ft. vertically, wiping out a long stretch of the trestled hoistway and covering the ore floor to a depth of 100 ft. with loose material and rock. The discharge pipe from a triple-expansion Worthington pump operating at the main sump 500 ft. below the surface had been swept away and the workings began to fill with water. Before pumping was resumed water had risen in the lower workings 200 feet.

Portions of the workings were still accessible through break-throughs at other points on the outcrop farther up on the strike. An examination under the collar of the shaft in the pit floor, showed that slabs from the hanging wall had covered the opening and had blocked any further slide of débris into the newer workings. The rock filling at the collar had been reinforced by ice which had formed from the percolating surface water.

Method of Reclaiming Hoistway

In the early spring Superintendent Clonan and I made preparations to reclaim the hoistway. The sides of the open pit were trimmed, the fallen stuff was partly leveled and sinking was begun to provide a shaft through the earth and rock. The 100 ft. of obstruction was of a very sandy nature piled up in the shape of a cone and during the period of sinking was in a constant state of movement.

Long shaft bearers, four in all, were laid and anchored in place by four 1⅛-in. cables, hung at the corners and made fast to iron plugs back on the footwall.



SECTION, MINE 21, SHOWING RECLAIMED SKIPWAY

*Mining engineer, Mineville, N. Y.

As sinking advanced on the 57-deg. angle, breast boards of varying lengths were used on the hanging-wall side. They were held in place by props resting against the material on the footwall side of the shaft. The wall plate was first introduced, the set interval lagged with 3-in. plank, and whenever possible the breast boards were removed. The footwall plate was next placed and finally the end pieces and divider. Very frequently the hanging plate would move back, and to place the last three sticks, it would be necessary to jack the wall plates. Shaft sets of square-set pattern were used and introduced at 2½-ft. intervals providing two compartments, 6x7 ft. inside measurement.

The weight of the earth on the hanging-wall side snapped many of the 1⅛-in. hanging irons first used; they were replaced by 1¼-in. iron, and great care was taken to have them cooled properly at the hook. Frequently, to hold back the drift, it was necessary to drive piling, but the presence of so many large boulders in the fallen material made this a slow method of procedure. Necessarily some block holing had to be done during the course of sinking, in which case crude logs were piled over the rock and also spiked to the timbers.

As the weight on the bearer cables increased, because of the timbering and also because the drift was in a state of movement, constantly pulling on the timbers, it was necessary to use more cables to keep the shaft sets near the true alinement. They were clamped at the hanging-wall corners around the wall plates and end pieces and drawn taut to other iron plugs on the footwall. As sinking progressed tracks were laid and by using lap-slides the skip cars were lowered to the bottom of the shaft, and the loose material was hoisted to the surface.

At a depth of 50 ft. the slabs, that blocked the collar 50 ft. below the last set of square-set timbering, gave away, and the bottom of the shaft fell out. It gave sufficient warning, so that the men in the shaft had time to climb some distance up the shaft timbers. The cave formed with funnel-shaped sides. Steeply sloping faces with large slabs from the hanging wall, boulders in the drift projecting from the sides, made the task of laying bearers at the bottom of the cave anything but desirable. The 50 ft. of timbering was still held fairly well in line by the cables.

Building up Cribwork

The next work was to trim the sides, to make it safe for men to work below. Again as little trimming as possible was done, for the material all fell to the bottom of the mine and had to be rehandled and hoisted to the surface. Men working with ropes around their waists, each attended by two men higher up who could pull them up in case of a fall from the sides, placed the first set of timbers on the collar.

Crib work of 10x12-in. yellow pine sticks was started up on the angle of 57 deg. to meet the 50 ft. of overhanging square sets. The sticks were thoroughly drift spiked and further strengthened by concrete walls built on three sides of the collar and to a hight of 15 ft. from the ore floor. After the crib work had been built to the proper hight, and had been securely tied to the overhanging square sets, track stringers were laid and timber was lowered from the surface to rebuild the trestled track below the shaft collar.

Log Abutment to Protect Timbered Hoistway

To protect the exposed timbered hoistway from any other falls, logs were lowered by the cableways and an abutment was built close to the timbered shaft, and on the west side of the open pit. Stretching across the bottom of the pit and for a hight of almost 100 ft. these logs were placed log-cabin crib fashion and filled with the fallen earth and rock until a level floor of sufficient area was made to catch any later falls and to prevent the material from rolling over and upon the timbered skipway.

Sinking through the fallen ground was a very tedious piece of work, and consequently no remarkable headway could be made. Two 10-hour shifts advanced on an average of 2 ft. per day. After the material from the three sides and bottom of the shaft had fallen through the collar, and crib work was begun, by working only in daylight a shift would advance 5 ft. in the 10 hours.

Gasolene Traction Drill

Drilling machines operated by gasolene power have been manufactured for a number of years, but only recently have these machines been so arranged that they could be moved from place to place by their own power. As these machines have to be moved over all sorts of roads it is essential that the power should be so mounted that the tortional strains shall not fall upon the moving parts. Certain features of automobile construction are being adopted, such as replacing the old friction drive by cluches controlling the forward and backward movements, the gears for each being always in mesh.

When set up ready to drill the road-driving clutch is thrown to neutral position, and the engine is connected to the drilling part proper with a belt and drilling commenced. A machine of this type made by the Cyclone Drill Company, of Orrville, Ohio, has the front axle stationary, the wheels swinging in knuckles. Other features of this company's latest type machine are: A positive clutch for the spudder crank; a specially designed clutch to start or stop drilling without shutting off the engine; control of the engine speed by a worm gear that increases or decreases the tension of the governor spring; magneto and battery system of ignition, two spark plugs being used.

WEST SIDE OF PIT, AFTER THE FALL

MINE 21, OPEN PIT AND HOISTWAY

Rhodesian Mines

Gold production in Rhodesia in January is reported at 48,621 oz. fine, a decrease of 3016 oz. from December. By values the production for the month was $970,316 in 1908, and $996,041 in 1909; an increase of $25,725 this year.

Other production reported for January was 20,172 oz. silver, 9 tons copper, 69 tons lead and 628 tons chrome ore. The coal output from the Wankie mines was 11,725 tons.

Behavior of Calcium Sulphate at Elevated Temperatures with Some Fluxes*

By H. O. Hofman and W. Mostowitsch.

Hydrous calcium sulphate loses its combined water at about 900 deg. C. Anhydrous calcium sulphate heated at atmospheric pressure in pure dry air remains unchanged up to 1200 deg. C. At 1200 deg. it begins to be dissociated, with the separation of sulphur dioxide and oxygen, as at this temperature sulphur trioxide cannot exist as such. The rate and degree of dissociation vary with the time and the temperature. Calcium sulphate fuses at about 1360 deg. C. and is more or less decomposed; the resulting product is a mixture of calcium oxide and sulphate; the proportions of the components vary with the time and temperature of the preliminary heating. Silica decomposes calcium sulphate at an elevated temperature; the decomposition begins at 1000 deg. C. and is finished at 1250 deg.; the product contains only calcium oxide and silica; the reactions taking place may be expressed by

$$CaSO_4 + SiO_2 = CaSiO_3 + SO_2 + O$$

$$2\,CaSO_4 + SiO_2 = Ca_2SiO_3 + 2\,SO_2 + O, \text{ etc.}$$

The examination of the product leads to the conclusion that the formation-temperature of calcium silicate lies below its melting-temperature.

Pure ferric oxide heated at atmospheric pressure in pure dry air is not dissociated at 1500 deg. C. Pure ferric oxide begins to decompose calcium sulphate at 1100 deg. C.; the decomposition is finished at 1250 deg.; ferric oxide requires on the whole higher temperatures to decompose calcium sulphate than does silica, but the decomposition proceeds at a more rapid rate. The process taking place may be expressed by the reaction

$$CaSO_4 + F_2O_3 = CaO.\ F_2O_3 + SO_2 + O.$$

The calcium ferrite formed fuses at 1250 deg. C.; it has, however, the property of dissolving calcium sulphate and of decomposing it, which indicates the existence of ferrites other than given by the formula.

Pure lead oxide has no decomposing effect upon calcium sulphate.

The Carmichael-Bradford Process

The gypsum added to the charge of raw sulphide lead-ore, characteristic for this mode of blast-roasting, is decomposed mainly by silica and ferric oxide; the sulphur dioxide resulting from the dissociation of sulphur trioxide set free enriches the gases.

*From *Bulletin*, A. I. M. E., January, 1909.

Gypsum has no decomposing effect upon galena.

The lead sulphide of the charges is oxidized by the oxygen of the air blown into it; the sulphur trioxide dissociated into sulphur dioxide and oxygen at the temperature of decomposition of calcium sulphate cannot have any oxidizing effect in hot parts of the charge; in the upper cooler region of the converting pot there is a possibility of some sulphur trioxide being formed from sulphur dioxide and oxygen with the assistance of a catalyzing effect of the charge, but even here the newly formed sulphur trioxide can hardly have any oxidizing effect, as the equations

$$SO_3 = SO_2 + O - 22{,}600 \text{ cal.}$$

$$PbS + 3\,O\ (\text{air}) = PbO + SO_2 + 104{,}000 \text{ cal.}$$

point toward the strongly exothermic direct oxidation by means of the excess of free oxygen present in the gases.

The decomposition of calcium sulphate with the simultaneous dissociation of sulphur trioxide,

$$CaSO_4 = CaO + SO_3 - 95{,}000 \text{ calories,}$$
$$SO_3 = SO_2 + O - 22{,}600 \text{ calories,}$$
$$-118{,}200 \text{ calories,}$$

represents two strongly endothermic reactions which must be favorable to the roasting of galena, as they counteract any tendency to local overheating and consequent fusion of the charge.

Further, the sulphur dioxide set free has a loosening effect upon the charge and thus acts favorably upon the process. From the thermal considerations it appears that in blast-roasting galena, calcium sulphate has a more favorable effect upon the result than calcium carbonate, which, according to

$$CaCO_3 = CaO + CO_2 - 45{,}150 \text{ cal.,}$$

absorbs less heat.

Ordinary Oxidizing-Roast.

In the ordinary oxidizing-roasting of ores the temperature is usually not raised to above 900 deg. or 1000 deg. C. As gypsum is not decomposed at this temperature, its presence can but have the effect of increasing the percentage of sulphur in the roasted charge.

Oxidizing-Roast of Calcareous Blende

In the oxidizing-roasting of calcareous blende the calcium carbonate is converted into calcium sulphate; and the latter, not being decomposed at the temperature of from 1200 to 1250 deg. C. attained in the operation, might be expected to increase the sulphur content beyond the degree it actually does were it not for the presence of small amounts of silica in the gangue and of isomorphous iron sulphide in the blende converted into ferric oxide, both of which favor the decomposition of calcium sulphate, and are thereby helpful in the diminution of the sulphur content.

Reduction of Roasted Calcareous Blende

On the other hand, the presence of large amounts of isomorphous iron sulphide in blende, as in many marmatites, has a harmful effect upon the reduction of roasted calcareous blende on account of the low temperature (1250 deg. C.) at which calcium ferrite fuses. The reduction of zinc oxide in practice is carried on at a temperature of 1300 deg. C.; the fused calcium ferrite, which is very fluid, will penetrate the charge, hinder reduction, and make rich residues; further, it will have a corrosive effect upon the retort material.

Knudsen Process for Pyritic Smelting

In this process, it will be remembered, copper-bearing pyrite is smelted in a converter lined with dolomite. Practical experience has shown that the more basic—i.e., the richer in iron—the slag, the more quickly will the lining be slagged, while slags with a reasonably high percentage of silica do not corrode the lining as rapidly. The reason for this peculiar fact now finds its explanation in the formation of readily fusible calcium ferrate. The experiment given on page 68 has shown that magnesium ferrite does not form at a temperature as high as 1500 deg. C.; hence, the richer in magnesia the dolomite, the more resistant will it prove to slagging.

Basic Steel Processes

The facts stated in the preceding paragraph regarding the ease with which calcium oxide is slagged by ferric oxide, and the difficulty of forming a magnesium ferrite, are important as regards the lining of basic-steel furnaces. Here it has also been found in practice that magnesia resists the corrosive effect of an irony slag much better than does lime.

Role of Ferruginous Slags in Non-Ferrous Smelting

The fluxing effect that basic slag rich in iron from copper- or nickel-refining furnaces has upon the blast-furnace-charge of acid ores, may be explained in part by the fusibility and fluidity of calcium ferrite. This oxide slag readily dissolves the less-fusible component parts of the charge, and helps to form at the desired temperature a slag of the required fluidity. The general principle of slag-formation by solution has been proved experimentally in a different way by Doelter,[1] who found, in observing slag-formation under the microscope, that the process was one of solution, in which the mineral having the lower melting point, after fusing, dissolved the one having the higher.

[1] "Physikalisch - Chemische Mineralogie," Barth, Leipsic, p. 127 (1905).

The Mining Industry in Queensland

The Chief Product of the Mines near Chillagoe Is a Copper-Lead-Silver Ore Averaging 8 Per Cent. Copper and 17 Per Cent. Lead

BY GERARD W. WILLIAMS*

The state of Queensland is one of the largest and least known of Australian colonies. It extends from the 29th to the 11th parallel and is bounded on the western side by the 138th meridian, the greater part of the state, therefore, lying within the tropic of Capricorn. The mines may be conveniently grouped as follows: The Northern fields comprising the Herberton tinfields, the copper country that extends for a radius of about a hundred miles around Chillagoe, and the goldfields of the extreme north; the Northwestern district comprising what is generally known as the Cloncurry field, the most important mineral here being copper; the Charters-Towers goldfields, the copper-gold district of which Mt. Morgan is the natural center; and the goldfields of Gympie. The various fields will be considered in this order.

The town of Chillagoe is situated 140 miles by rail from the port of Cairns. Along the coast and roughly parallel to it runs a range of the mountains varying in hight from 2000 to 5000 ft. This belt of country, some 40 miles wide, is well timbered and of proved fertility but beyond the landward slopes of the range the country passes into rolling plains sparsely timbered with small eucalyptus and covered with indifferent grass. Geologically the country consists mostly of highly altered sedimentary rocks overlying granites. Newer intrusive rocks penetrate both the granites and the sedimentary series which are of Silurian age. Chillagoe itself is situated at the junction of the granite and the slates with the Permo-Carboniferous limestones which outcrop in bold craggy scarps sculptured into fantastic shapes.

The Copper Mines

The chief mines in this district are, the Ruddigore, Zillmanton and Mungana mines, in the neighborhood of the town, the O. K. about 60 miles northwesterly and the Einasleigh 120 miles south.

As these mines all present different geological features a brief description will be given of each.

The Ruddigore—This mine, the property of the Chillagoe Railways and Mines (Ltd.), is situated 2½ miles by rail from the smelteries at Chillagoe. It is a low-grade copper mine. The orebody appears to consist of a stockwork of chalcopyrite in a quartz porphyry; the surrounding rock is granite. As exposed by an open cut, now 100 ft. in depth, the main shoot is 270 ft. long and 40 ft. wide with an average copper content of 2.75 per cent. At present this ore is hand picked up to 4 per cent. and shipped to the smelteries. The lode is nearly vertical, the hanging wall being clearly shown, but on the footwall side there is no defined wall and the values pass out into the granite country. From bore holes the lode has been shown to extend to 250 ft. in depth. The present mining manager for the Chillagoe mines, J. Rhodda, is engaged in sinking a shaft in the western country rock with a view to opening up the lode at 125, 225 and 325 ft. respectively. Till this is done it is naturally impossible to estimate the real value of the mine.

At the *Zillmanton,* which is situated about two miles from the smelteries, the orebody occurs as a contact lode between granite and limestone. The mine is interesting from a geological point of view in that it is intermediate in character between the pure chalcopyrite granite orebody of the Ruddigore and the limestone deposits of copper-lead-silver-zinc ore at Mungana. The limestone is entirely converted into massive calcite and on the side of the orebody there is a layer of varying thickness of soft ferruginous clay. This clay renders mining extremely difficult for from its nature it makes a dangerous hanging wall and moreover it forms an impervious layer which dams back the water in the limestone. In places this clay becomes so thin that the water breaks through making the mine liable to flood. The whole limestone country is extremely wet. In developing the bottom level (350 ft.) the main level was carried in the solid granite and exploratory crosscuts and false drives run out into the orebody. At the time of my visit the workings were flooded.

The Mungana mines—These mines, of which the Lady Jane and the Girofla are the most important, are the property of the Mungana Mines (Ltd.), a subsidiary company of the Chillagoe Rails and Mines (Ltd.). They lie in a wide ore belt that runs in an east-west direction through the massive Permo-Carboniferous encrinoidal limestone. The ore channel is proved for about three miles and numerous mines have been opened up on it. In one place a dike of granite crosses the orebody, converting the limestone on the contact to garnet rock. The limits of the ore are in some instances marked by the occurrence of crystalline schists. The orebodies consist of more or less persistent caverns in the limestone which have been filled with mineral. The Lady Jane has been opened up to 426 ft. in the mine shaft, but the lowest level is 320 ft. Work on the 420 has been delayed owing to influx of water from a water course in the limestone, tapped in sinking.

The deposit takes the form of an almost vertical chasm in the limestone. In section it resembles an open fan and at the 320 level measures 260 ft. in greatest length by 60 ft. across the center. At the 210 level the deposit was 60 ft. longer and 10 ft. wider. The actual outline, however is irregular and varies considerably from one level to another. The nature of the ore too varies widely. On the same sill floor it is possible to pass from a straight copper ore assaying 30 per cent. metal in black sulphide through an intermediate sulphide ore containing black copper, galena, blende and anglesite, to a straight silver-lead ore. Lots of copper ore assaying 51 per cent. metal have been shipped. Black sulphides exist on the 320 level and in a winze sunk to 69 ft. below that level, thus indicating the essentially secondary nature of the deposit. The average shipping grade of copper-lead-silver ore is 6 per cent. copper, 21 per cent. lead, and 20 to 25 oz. of silver. The "copper" ore varies from 10 to 20 per cent. copper, 4 to 14 per cent. lead with from 4 to 50 oz. silver. As will be shown later this latter ore is treated only for its copper and silver.

The orebody does not stand well in mining and in consequence is timbered with square sets which are kept well mullocked up. The sets are constructed of round timber, the manner of cutting being shown in Fig. 1. An interesting phenomenon was observed in the stope over the 320 level. The stopes were up on the fifth set at the time when without warning the timbers began to take weight badly. Despite all strengthening it was found advisable to cease work and every effort was made to keep the drive open. Legs and caps were smashed in almost as soon as placed in position and at one time it appeared certain that the level must be lost. The No. 4 winze was sunk from the 210 level but when down to 54 ft. it was necessary to cease work owing to the intense heat. A blower was started but before work was resumed the heated air in the cavity *X*, shown in Fig. 2, was accidentally tapped through the winze No. 1 and escaped along the 210-ft. level driving out all men from the stopes above for several days.

*Consulting engineer, Stock Exchange Club, Melbourne.

On examination the following conclusion was arrived at: At some time the ground at *X* fell and in falling sealed the outlet of the fissure into the old No. 1 winze, which had previously acted as a a vent; as oxidation proceeded the temperature and pressure of the inclosed air increased, and the broken ground acted as a great piston forcing down all the stope and drive sets with irresistible pressure. Some idea of the pressure may be gained from the fact that when the gas escaped from the No. 1 winze the floor of the new No. 4 winze fell into the cavity. The floor was only 14 in. in thickness but together with the broken ore lying on it, it had been held up against the winze by the caisson pressure inside.

At the Girofla the nature of the ore deposit is similar but there are two shoots at the surface which unite at the 410-ft. level. This mine is lower grade in depth than the Lady Jane, the ore on the 510 level averaging 2.2 per cent. copper, 20 per cent. lead and 6 to 12 oz. silver. From this mine large quantities of "flux sulphide" are mined and sent to the smelteries at Chillagoe, ten miles distant. This flux contains 1.5 per cent. copper, 12 per cent. lead and 6.5 oz. silver.

The carbonate levels of all the Mungana mines have yielded rich carbonate and oxide ores. The whole ore channel contains mineral deposits many of which have already been located and it is quite certain that exploratory work with the diamond drill will result in the opening up of other deposits. As to the permanence in depth of these cave deposits it is difficult to speak with certainty. The fissures or caves in which the minerals are deposited may extend downward for a considerable distance, but the presence of zinc renders it highly probable that in the primary zone the copper will be replaced by that metal. The Chillagoe company controls several other mines along the granite-limestone belt but none of these were working at the time of my visit. They are only profitable when copper stands at a high price.

The Chillagoe Lead and Copper Smelteries

The smelteries of the Chillagoe Rails and Mines Company, are situated at Chillagoe, 149 miles by rail from Cairns. As indicated in the foregoing description of the mines supplying ores to the smelteries highly complex ores have to be treated. For working purposes all ores received are classified as lead or copper ores according as they are treated in the lead or the copper-blast furnaces. The accompanying table shows the chemical composition of the ores at present being treated.

From time to time small parcels of high-grade copper ore are treated.

Lead Smelting

The ores treated in the lead smeltery are the Lady Jane and Girofla sulphide and oxide ores (excepting the "flux sulphides") together with purchased ore from the Consols mine. The Lady Jane and Girofla ores are mixed in the proportion of 2 to 1 and crushed through a No. 5 Gates crusher, the product passes to a 36x30-in. Krupp roll and from this through another similar roll which delivers to the boot of an elevator. Half of this crushed ore is fed to two large Edwards roasters. The latter measure 89x16 ft. over all, the inside hearth measuring 83x14 ft. The hearth has a fall of 5 deg. (¾ in. per ft.). There are two rows of 20 rabbles, the arms are 3 ft. 6 in. long with five "feet" to each arm. The rabbles are driven from two 3-in. shafts which run the length of the roaster. The roof of the roaster is 1 ft. 5½ in. in the center arching down to 10 in. at the sides. The fireboxes are three in number, one at the end and two placed in the middle. Opposite to each rabble is a port, 9x10 in. The rabbles revolve at the rate of 1 r.p.m. (the last four travel somewhat faster) and discharge to a cross tunnel from which the roasted ore is removed by a push conveyer. Each roaster treats from 30 to 50 tons per day according to the degree of desulphurization required. The size and sulphur content of the partly roasted material is as follows, the second figure representing percentage of roasted ore, and the third figure, the per cent. of sulphur it contains: On ½ in., 15, 14.1; on ¼ in., 12.3, 12; on ⅛ in., 7.5, 11.4; on 20 mesh, 22, 10.9; through 20 mesh, 43, 6.3. The loss in weight is about 15 per cent.

The roast is wetted and after mixing with unroasted sulphide ore and some limestone is charged to the Huntington-Heberlein converters, of which there are 12 with kettles of 10-ton capacity each. Each pot or kettle averages 2.5 blows per day with air at 20 oz. The company is under agreement not to publish details of the working of this plant although it is not easy to see what danger to the patentees would lie in such publication. From the converters the blown charge is dumped direct onto the floor beneath. The kettles swing over and after the charge falls out they swing back again for the new charge which is run in from hoppers connected with the feed bins above. The fines, which average 70 per cent. and consist largely of unsintered sulphides, are mixed with sulphide ores and reblown. At the time of my visit, work on these kettles had been greatly improved and, as a result of certain changes in the sulphur content of the charge, the fines had been materially reduced. The sintered charge has approximately the following composition: Silver 12 oz. per ton; copper, 4 per cent.; lead, 20; silica, 15; ferrous oxide, 27; lime (CaO), 1.2; zinc oxide, 15; sulphur, 4.5. From the floor beneath the Huntington-Heberlein plant the lumps of sinter are spalled up and railed to the smeltery floor.

The lead furnace has a rectangular water jacket, 40x160 in. at the tuyeres. From the top of the crucible to the feed

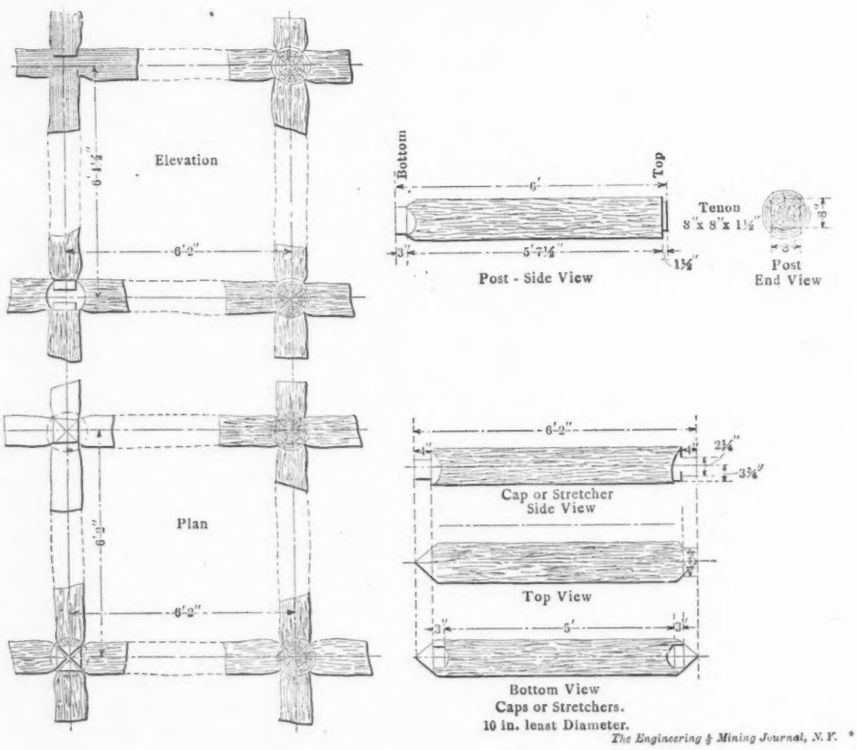


FIG. 1. METHOD OF FRAMING ROUND TIMBERS

floor is 18 ft. 6 in. and the water jacket extends 8 ft. above the tuyeres. The jacket measures (inside) 5 ft. 8 in. by 14 ft. 10 in., is straight sided and built of 5/8-in. mild steel. There are nine tuyeres 4 in. in diameter to each side. The furnace charge is approximately:

H-H product	3200 lb.
Oxidized Girofla	600 "
Limestone	400 "
Lead slag	700 "
Copper slag	400 "
Dirty lead mattes	400 "
Lead dross	300 "

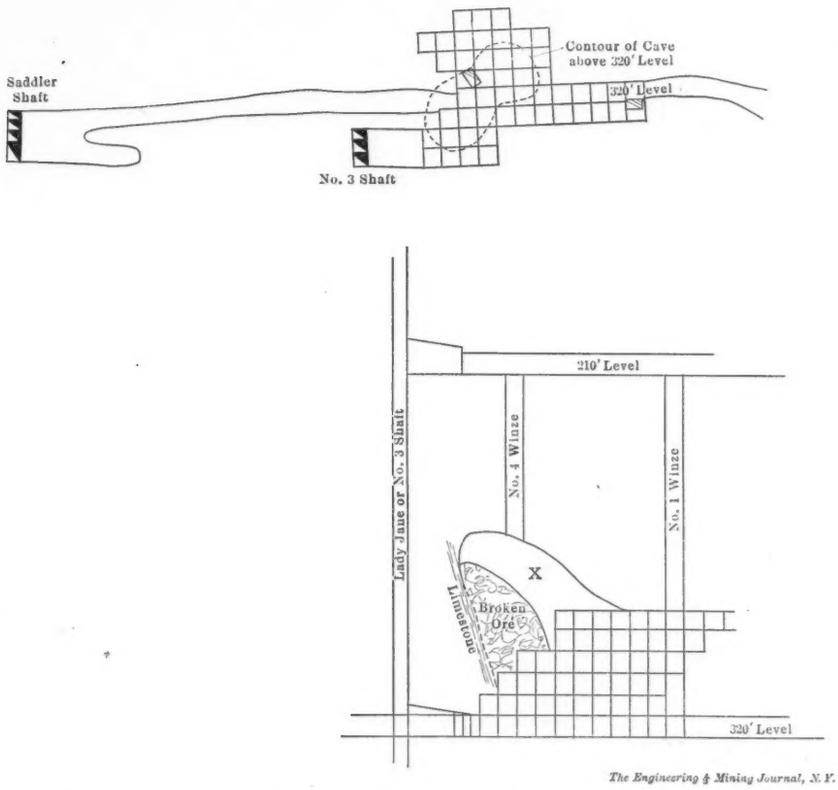


FIG. 2. LADY JANE SHAFT AND PORTION OF WORKINGS SHOWING CAVE

It is made up in three heaps on the charging floor and a barrow load of coke equal to 13.5 per cent. added to each heap. Sixty-three charges go through per day (24 hours).

From the furnace the following products are obtained: (1) Lead bullion, 17 tons, 60 to 65 oz. silver per ton; (2) dross from the lead well, 8 tons; this is returned to the furnace; (3) matte, 20 to 25 tons; this matte averages: lead, 19 per cent.; copper, 23; sulphur, 20; ferrous oxide, 25; zinc oxide, 10 and silver 16 oz. It is tapped into cooling launders of cast iron from which it is broken out and sent to the copper furnace. (4) Slag. This averages: Silica, 25 per cent.; iron (FeO), 35; lime (CaO), 12; zinc (ZnO), 16.5; lead, 2.0; copper, 0.55; sulphur, 3.0; silver, 0.5 oz. per ton.

The lead bullion contains less than 0.25 per cent. copper. The recovery of lead varies from 85 to 89 per cent. of the "available" lead. The "available" lead is the percentage of lead less the percentage of copper, i.e., on an ore containing 26 per cent. lead and 4 per cent. copper the available lead would be 22 per cent. Recent experiments on blowing up the lead-copper matte direct, have been encouraging and this is looked upon as a possibility for the future.

Copper Smelting

The copper furnace measures 160x40 in. at the tuyeres, the water jacket extending up 7 ft. 9 in. The feed floor is 18 ft. above the level of the tymp. There are sixteen 3-in. tuyeres arranged in two rows of eight each on the longer sides of the furnace. The tymp measures 3 ft. 4 in. by 18 by 6 in., and is constructed of 5/16-in. copper.

The average day's run for the past three months has been: Ruddigore ore, 40 tons; Queenslander ore, 30; Lady Jane oxidized and carbonate, 15; lead matte from lead furnace, 20; Girofla flux sulphide, 15; limestone, 30; high-grade mattes (40 per cent. copper), 9; lead slags from lead furnace, 20; coke, 6 per cent. on the charge. From the smelteries the daily returns averaged 24 tons of matte containing 50 per cent. copper, 13 lead, 4 zinc, 16 sulphur and 16 iron (FeO). An average slag composition has been: silica (SiO_2), 37 per cent.; zinc (ZnO), 4; alumina (Al_2O_3), 9; iron (FeO), 26; lime (CaO), 19; lead, 3; copper, 0.4 and silver, 0.4 oz. per ton.

The converters are two in number but the present air supply is only sufficient to keep one blowing at a time. When freshly lined their capacity is about 1½ tons which is increased to 6 tons on the fifth "blow." Generally speaking each lining treats 11 tons of copper. The following notes, taken from the time slate illustrate the time required for converting: "Charged with 2 tons matte, blowing for 45 min., slagged off. Slag very viscous and has to be rabbled. Two tons of matte added, blowing for 20 min., and another half ton of slag skimmed off. After a further blow of 6 min. the converter slagged, and the metal, 2.1 tons of 99-per cent. blister, poured into molds." The blister assayed 100 oz. silver per ton. The gold content was inappreciable.

During blowing a large portion of the copper scorifies out into the slag, the action being very similar to that which takes place in an ordinary scorifier during the treatment of copper lead. The converter slags have the following composition: Silica, 22.5 per cent.; ferrous oxide, 34.5; zinc oxide, 13.6; alumina, 5; copper, 8.5; lead, 20; sulphur, trace.

The quartz used in the converter lining contains 92 per cent. silica. Eight parts of it are mixed with four of binder composed of red clay obtained locally and two of old liners. The lining is tamped with small pneumatic hammers. The dust is returned to the converters and the slags are stored and smelted periodically in the lead furnace with a charge of the following proportions: Converter slags, 88 tons per day; H-H product, 25; Girofla lead sulphide, 34; limestone, 20; lead dross, 6; coke, 14 per cent. on charge.

The production per day averages: (1) Lead bullion, 11 tons; (2) Copper matte; lead, 26; copper, 35 per cent., goes to the copper furnace; (3) Slag. The composition of the slag is: Silica, 25 per cent.; ferrous oxide, 37; lime (CaO),

COMPOSITION OF ORES TREATED AT CHILLAGOE SMELTERY.

Name.	Silver. (Oz.)	Lead.	ZnO.	Copper.	FeO.	Silica.	Sulphur.	Alumina.
Lady Jane sulphide	11.5	20.0%	18.0%	4.0%	22.0%	12.5%	23.0%	
Girofla sulphide	5.7	17.5%	9.0%	2.0%	32.0%	9.0%	20.0%	
Ruddigore	1.0			4.0%	9.0%	60.0%	4.0%	13.0%
Consols (purchased)	23.5	30.5%	19.2%	0.25%	19.3%	6.0%	23.5%	
Girofla oxidized	14.3	16.7%	1.8%	8.4%	26.0%	22.4%	3.0%	
Girofla flux sulphide	6.2	7.5%	7.0%	1.0%	37.5%	12.0%	19.2%	
Mungana oxidized	11.0	13.0%	1.0%	10.0%	20.0%	27.5%	2.0%	
Queenslander	4.0		6.0%	4.0%	28.0%	18.0%	22.0%	6.0%

13.5; zinc oxide, 12.5; lead, 3; copper, 0.5.

The running of this charge has a most beneficial effect upon the furnace, all zinc accretions upon the sides and bottom of the crucible are cut out and the whole furnace is washed out clean. Previously these converter slags were returned to the copper furnace but the process had to be discontinued as the slags ran up high in copper.

The lead furnace was blown in on the first of January, '08, and was running well at the end of September. The copper furnace started a few weeks later and has run continually except for a few days' stop caused by lead and "mush" getting into the well. This furnace is running below its true capacity for it is necessary to run it side by side with the lead furnace in order to treat the mattes. The supply of straight copper ore is somewhat limited at present. Another lead furnace has been blown in and work is proceeding on a new one for copper.

The difficulty of copper smelting on these complex ores lies in the fact that if the coke is allowed to increase lead bullion is reduced and this collecting in the well chokes up the furnace. Practically no lead is recovered from the copper furnace, the bulk being volatilized and the rest going into the slag. A small quantity goes into the matte and is mostly blown out in the converters. Smelting practice at this plant is still in a transitional stage but immense improvements have been effected in little over a year's time since the present manager, J. Horsburg, took charge. Hampered by expensive freight, costly and not too efficient labor, and a badly laid out plant, the work done by the smelters is more than creditable, and marks a new and entirely successful departure in Australian metallurgy. As time goes on and the operations of the Chillagoe Mines and Railway extend, these smelteries will become of immense importance not only to the company but to North Queensland as a whole. The entire district traversed by the Chillagoe railways is mineral bearing but in most cases the ores are extremely refractory.

The O. K. Copper Mines, Ltd.

The leases owned by the O. K. company are situated 50 miles north of Mungana, the terminus of the Cairns-Chillagoe line. The intervening road is bad, even for North Queensland. For three months of the year, during the rains, the roads are almost useless and the dry creeks of summer, over which they run, become raging torrents. In the immediate vicinity of the mine the country rock consists of quartzites and shales, the latter of Silurian age, which have been subjected to considerable dynamic metamorphism and as a result it is difficult to state definitely what was the original nature of much of the rock. Petrologically the "country" varies from a highly silicious, massive greenish rock containing a small amount of hornblende to a rock composed of granules of aluminum silicate with secondary quartz and calcite. The schistose nature of the rock in the immediate neighborhood of the lodes is essentially secondary, induced by pressure and side movements. In some respects the rock is not unlike the amphibolites which compose the lode-bearing rocks of Kalgoorlie (West Australia). No rocks which can be definitely referred to an igneous origin are found in the mine.

As is the case with most of the mines in the Chillagoe district the surface gozzans are well leached and have proved of little value. Patches of carbonate and silicate of copper were found but they proved of comparatively small extent. The black sulphides come in at water level (55 ft.). The mine has been opened up to a depth of 200 ft., but there are indications that this level will be the last to yield payable ore. Therefore, this mine is of interest chiefly from a metallurgical point of view. With the addition of limestone the ore is practically self-smelting, basic and silicious ores occurring in approximately equal quantity. The composition of the ore is as follows, the first figure being for basic and the figures in parentheses for silicious ore: Silica (SiO_2), 5 to 20 per cent., (40 to 70 per cent.); iron (FeO), 29 to 50; (7 to 18); alumina (Al_2O_3), 0 to 2; (1); lime (CaO), 0 to 5; (1); copper, 2 to 8; (8 to 20). Only a very small proportion of the ore is oxidized; the rest is sulphide ore.

The furnace measures 72x36 in. at the tuyeres and is 11 ft. to the feed floor. It is fitted with a crucible for inside settlement and the slag and matte are tapped intermittently.

The average daily charge is made up of 35 tons basic ore, 35 silicious ore, 16 limestone and 14 of converted slags, flue dust, etc. The smelting is semipyritic, 5 per cent. of coke being used. Flue dust is heaped up in the open and after weathering for a few months it is made up in a Huntington mill with 25 per cent. of kaolin ore. The mass is made into briquets by hand and after drying these are fed to the furnace. The slag runs about 40 per cent. of silica and 32 of ferrous oxide. The metal recovery is given as 90 per cent. Attached to the smelting furnace is a converter, which runs only two shifts a day, matte produced on night shift being returned to the furnace on day shift. The matte averages 48 per cent. copper.

All stores have to be brought 50 miles by road, 10 traction engines being used for this purpose. Mining costs $4 per ton (2240 lb.), smelting $6 and converting $20 per ton of metal. With average ores, (8.5 per cent. copper), blister of 99 per cent. is produced at the mine for $205 per ton or delivered on the wharf at Cairns for $230 per ton. Labor costs $2.50@3 per shift of eight hours, and it is not too efficient.

To date the company has smelted 57,000 tons of ore for a return of 6360 tons of copper. The mine is now treating 8.5 per cent. of ore of which there is an estimated reserve of 30,000 tons. On another lease about a half mile away a rich shoot of black sulphide ore is being opened up.

The mine is only a small one but it has had a distinctly successful career having paid half a million dollars in dividends end erected a plant to the value of $240,000 on an original capital of $15,000. The working limit, with copper at $350 per ton appears to be 6.5 per cent. ore so that there is but a poor outlook when the primary ore is reached. As in most mines in this district zinc occurs in the ore. Despite its small size the mine is of interest as an example of the small scale smelting which is carried on in mines remote from railways and ports.

Australasian Gold Returns

Gold output in Western Australia in February was 123,116 oz. fine. For the two months ended Feb. 28 it was 281,315 oz. in 1908, and 255,383 oz.—or $5,278,767—in 1909; a decrease of 25,932 oz. this year.

In February New South Wales reports 28,222 oz. gold. For the two months ended Feb. 28 the total was 45,340 oz. in 1908, and 48,107 oz.—or $994,373—in 1909; an increase of 2767 oz. this year.

New Zealand gold production in February was 33,443 oz. bullion in 1908, and 41,265 oz. in 1909; an increase of 7822 oz. The bullion reported this year was equal to $794,461, or 38,581 oz. fine gold. Silver reported was 133,387 oz. in 1908, and 154,258 oz. in 1909; an increase of 20,871 oz. this year.

The growth in size of Lake ore carriers is illustrated by a statement showing the average cargo of vessels loaded at the Duluth, Missabe & Northern ore docks in Duluth for a series of years, in long tons:

1895	1,809	1906	6,973
1900	3,783	1907	7,516
1905	6,037	1908	8,325

The average cargo of 1908 was more than four and one-half times that of 1895—and was handled in a shorter time.

The Associated Oil Company is building a pipe line from the Sherman oilfield in California to the port of Redondo in Los Angeles county. Wharves are also being built at that place. The Mitsui company is preparing to put on a regular line of tank steamers to carry oil from Redondo to Japanase ports.

Mining Enterprises in France

SPECIAL CORRESPONDENCE

The mining interests owned by French capital are of two kinds. Sometimes these enterprises are due entirely to foreign initiative with controlling companies constituted under foreign laws; sometimes they are due only to French initiative and capital and are controlled by French companies. The former plan owes its popularity to the success of the Transvaal gold mines in 1895. The French public at that time became familiar with the shares of the English companies, some of which sold practically all their stock in France. Although some French financial groups tried to take a direct interest in these companies their efforts came too late and met with little success. Of the two banks organized at that time to deal in the gold mines, the Banque de l'Afrique du Sud and the Compagnie Française de Mines d'Or et de l'Afrique du Sud, only the latter continues business at this time. However, the principal Rand trusts have still their own offices in Paris.

Gold mines take a considerable place in French investments and have an important market on the Paris Bourse. French capital is also largely interested in diamond mines. A large amount of De Beers stock—if not the largest part of it—is held by French capitalists. The Jagersfontein and the Premier Diamond have also a great number of French shareholders.

The mining shares in which French capitalists and speculators take the most interest are those of the Rio Tinto, whose prices are closely influenced by the American market, particularly by Wall Street. Besides the Rio Tinto we find very large investments in English companies, such as Cape Copper, Tharsis, Golden Horseshoe, Lagunas and Lautaro nitrates; in Belgian companies such as Asturienne des Mines, Vieille Montagne and many collieries; in German companies such as Harpener, Zincs de Silésie; in Italian companies, such as Montecatini; in Russian companies, such as Naphthes de Bakou; in Austrian companies such as Alpines, and in Turkish companies such as Balia-Karaïdin, Héraclea colliery, etc.

Aside from these financial interests in foreign companies there are a number of mining enterprises in which both management and capital are in French hands. The older of these companies were organized to work the French mines, especially the coal seams of the north and center of the country. As these mines are in rich industrial districts the promotors easily raised the money necessary for their large business. The French collieries, owing to their exceptionally good management, their sound financial organization and the regularity of their dividends, command prices for their stocks which yield an interest of 3 to 4 per cent. only.

France, having comparatively few mines, has not been contented with its own enterprises or with the financing of foreign companies. The law of 1893, which allowed mining companies, only "civil" up to that time, to adopt the commercial form of the "sociétés anonymes" (joint stock companies limited), gave a great impulse to the development of the mining enterprises in the colonies and abroad, but especially in Algeria and Tunis. The leaders in this line were some of the large financial groups, commonly called the "Haute Banque."

Among them the most progressive and successful one is the Banque Mirabaud. It started under the name of Société d'Etudes et d'Entreprises, an important bureau for the investigation of mining enterprises. Owing to the large means available and to care in the selection of mining experts, this bureau studies every proposal with a care that has almost excluded failure. The Banque Mirabaud controls entirely the Boleo in Mexico, the Phosphates de Gafsa in Tunis, the Penarroya in Spain, the Mokta-el-Hadid in Algeria, the Bor in Servia. It is largely interested in the Epinac colliery in France, in the Sels Gemmes et Houilles de la Russie Méridionale, in the Ouasta Mesloula (Algeria) in the Vieille-Montagne Zinc in Belgium. It holds also many interests jointly with Rothschild Brothers, not only in Boleo, Penarroya, in the doubtful enterprise of Inguaran in Mexico, but also in undertakings special to the latter group and above all in the Nickel Company, which, by its connections with the International Nickel Company, controls the European market for nickel. Its mines are in New Caledonia and its smelting works are in England, France and Germany.

Next to the Mirabaud and Rothschild groups, the importance of which extends far beyond their mining enterprises, there exist a number of secondary groups of more recent date. We may instance:

1. The Bonnardel group, with interests in the Platinum Syndicate and the new gold-mining companies of French Guiana.

2. The Max Lyon-Achille Adam group with Catemou in Chile, Tuco-Cheira in Peru, and above all in Algeria and Tunis with Djebel-Ressas and Fedj-Assène.

3. The Vassal group with the Sosnowice colliery in Russia.

4. The Leonino group, chiefly interested in the French gold mines.

5. The Urruty group—representative of the Metalgesellschaft—dealing chiefly with Algerian and Tunisian mines such as Guelma, Safsaf and Kanguet.

6. The Bondeli group, with mines in the same countries, such as Djendli, and Djebel-Ressas; also connected with the Max Lyon group, and having unofficial help from the Credit Lyonnais.

7. The Rodocanachi group with Bou-Thaleb and French Laurium.

There are also different groups at Lyons and Paris with interests in Russian collieries and in gold mines in Madagascar, French Guiana and French West Africa.

The great banking institutions have often been criticized for their systematic indifference to industrial enterprises. This is not quite justified as some of them are directly or indirectly interested in mining companies. Among them may be instanced the Société Generale in Ekaterinowka and Routchenko, Russia; the Compagnie Française des Mines d'Or et de l'Afrique du Sud; the Omnium d'Algerie Tunisie; the Credit Industriel et Commercial in the Bethune colliery in France, the Czeladz Platinum in Russia, and the Omnium d'Algérie-Tunisie. The Comptoir National d'Escompte de Paris is interested in the Compagnie Française des Mines du Laurium, in Greece.

To complete this general note we must mention the considerable interests of the great iron works in the iron mines of Lorraine and Algeria.

Many important foreign firms, such as the Metallgesellschaft of Frankfurt and Müller, of Rotterdam, have representatives in Paris and take a part in the mining business of France. We may add that the principal foreign manufacturers of mining machinery such as Fraser & Chalmers, Ltd., Krupp, Humboldt, Gröppel, Bleichert and Koppel, have in Paris branches or agencies carrying on a large business with the mining companies.

The number and importance of French mining enterprises has increased considerably in the last few years, principally during 1905-1906, when the majority of the new undertakings were connected with mines. It has been frequently noticed that at the time of financial crises, French investors feel inclined to buy only bonds and mortgage securities, while during prosperous times capital is willingly applied to industrial undertakings and principally to mining.

At present signs of a revival are obvious. A number of new mining ventures are being planned, some of which are ready and only awaiting a favorable time for soliciting capital and adding a few names to the already long list of French mining enterprises.

The French bronze coins of 5 and 10 centimes are to be withdrawn from circulation (*Min. Journ.*, Feb. 6, 1909) and replaced by aluminum coins 3 and 7 grammes lighter in weight. The standard of the aluminum must not be less than 990/1000, which is the same as that of commercially pure aluminum. There are to be coined 348,750,000 ten-centime pieces and 562,500,000 five-centime. It has been pointed out that pure aluminum is too soft for this use, and experiments are being made to solve this problem.

The Mammoth-Grand Central Case

SPECIAL CORRESPONDENCE

The Federal Supreme Court has just handed down a decision in the case of the Mammoth Mining Company against the Grand Central Mining Company, the latter being a Utah and Colorado corporation. This was a suit begun by the Grand Central Mining Company to recover for the removal of ores from beneath the surface of its Silveropolis mining claim and for an injunction. The defendant, the Mammoth Mining Company, filed a counterclaim, setting up that it was the owner of certain mining claims which were said to be senior to all other claims concerned, and that the vein or lode from which the ore in question was taken has a part of its apex within the Mammoth Mining Company's original holding which, if true, would entitle the Mammoth company to the ore. The case was originally decided by the Supreme Court of Utah in an elaborate opinion, and it was then appealed to the United States Supreme Court on the ground that the decision rested on a definition of a lode or vein which the plaintiff in error contests, and which, therefore, turned on the construction of Revised Statutes, Sec. 2322. The Federal Supreme Court dismisses the writ of error largely upon the same ground that was taken by the Utah court. It lays great stress on the fact that the Mammoth company could not locate the hanging or footwall of the supposed vein, the presumption being that the ore belongs to the owner of the claim under which it is found. The mines in question are found in a lime belt, which covers about two square miles, and is the great producing area of the Tintic district. In some places the limestone beds are upturned, large areas tilted upon edge, the beds dipping vertically, while in other places they dip at lower angles and in special areas the dips are quite uniform; and again it seems, though not frequently, anticlinals exist. This limestone is surrounded on all sides except the north by igneous rocks. The sedimentary rocks are broken up and fractured—evidently the result of igneous intrusion. The limestone carries some iron in the different forms of iron oxide, also some manganese, and in places the limestone is crushed, crumbled and brecciated. The view is taken that under such circumstances a vein cannot be said to exist merely because the rock is crushed, shattered, or even fissured, and that what will constitute one must depend somewhat on the nature of the country in which it is alleged to be found. It is recognized that a true vein may be barren in places, but the decision of the Utah Supreme Court is accepted to the effect that to allow the Mammoth company's claim would amount practically to declaring the whole limestone area to be one vein, thousands of feet wide. The Federal Supreme Court, however, while noting that the Supreme Court of Utah expressed the opinion that there is a difference between a lode sufficient to validate a location and an apex giving extralateral rights, remarks that this question is not necessary to a decision in this case, and that it will not, therefore, express any opinion on that matter at the present time.

The National Conservation Commission

SPECIAL CORRESPONDENCE

It has been unofficially made known that at the recent meeting of the Joint Conservation Committee, which met last week in Washington in executive session, it was determined that the work of the committee could no longer go on under Federal control and at Federal expense. This committee is the organization resulting from the National Conservation Conference which met in Washington early last winter, and, on disbanding, left behind it resolutions favoring the establishment of a national committee under the control of the Federal Government to coördinate the efforts of the States and of private organizations in the interest of conservation. The committee was to consist of six members of State conservation commissions and three members of the national conservation commission, all of whom were to be designated by Chief Forester Pinchot, who was to act as chairman. Upon reaching Washington it was found by the members that the action of Congress in attaching to the sundry civil appropriation bill a rider prohibiting the use of funds of the National Government for the support or expenses of any board or commission not authorized by legislative enactment would prevent the expenditure of Federal moneys in connection with conservation. The work of the committee will, however, by no means be abandoned. There are at present about 37 State conservation commissions and about 50 committees of national organizations of private individuals, all needing leadership and aid. The committee intends to supply these, and it will rely for funds upon private contributions. Of the latter an adequate supply is understood to be in sight. At the recent meeting in Washington, a good deal of time was spent in considering this situation, but full attention was also paid to the large number of letters and suggestions received from the various State commissions and private organizations. A digest of these suggestions is being prepared and will probably be made known within a short time. No definite time has been fixed for the next meeting of the committee, but it is expected to occur soon.

The Bureau of Mines Bill

SPECIAL CORRESPONDENCE

After various efforts to get the bill to establish a bureau of mines before the Senate for discussion and a vote, it was finally brought up during the evening session of March 3, but a vote was prevented by a filibuster. Had a division actually occurred, probably the bill would have passed. The defeat of the measure was due to the success of opponents in preventing it from being taken up until the session was close to its end, when the time of the Senate could easily be occupied by anyone who wished to prevent the adoption of a given proposal. With greater energy and adroitness it would have been entirely practicable to have brought the subject to an issue much earlier. The final test, however, showed the location of the opposition as well as its character much more accurately than at any time heretofore. Those who were chiefly instrumental against the bill were Senators Clay, of Georgia; Teller, of Colorado; Clapp, of Minnesota, and Stone, of Missouri. With the concealed assent and support of a number of other senators this group was entirely adequate to accomplish the object in mind—the postponement of the bill to which they were antagonistic.

OBJECTIONS TO THE BILL

The principal objection to the bill, as developed in the course of discussion, was the unwillingness of the Senate to increase the number of Government bureaus and departments now in existence. Thus Senator Clapp voiced the apparently prevailing opinion, saying: "The bill is simply designed to establish another bureau for the government of this country and the government of Congress. Sooner or later Congress has got to take the stand that Congress will determine first and for all time in a session what the appropriations will be."

This view seemed to be supported by others on the ground that the marked success the Geological Survey has already had in enlarging its appropriations would be repeated in the case of a bureau of mines, were one to be created. The fear of interference with the "reserved powers" of the States also figured to some extent, Senator Carter stating that: "We have in the respective States certain laws relating to the inspection of mines. * * * The Federal inspectors of mines might prescribe one rule with reference to the safety of mines whereas the State law might prescribe another rule. How could the mining operator in the State of Montana, working a gold mine or a copper mine, determine when he was within his rights and complying with the law, should the law of the United States provide that an inspector appointed by the President, or by the bureau of mines, should insist

upon a rule fixed by Congress, whereas the State law provided for another rule of action entirely? I think the senator in charge of this bill should state clearly and distinctly the right, as he understands it, under our system of government for a Federal officer to enter a State to prescribe the method of conducting a mining operation in that State."

Senator Carter further remarked that the Federal Government had properly regulated and provided for inspection of coal mines in the Territories, and he thought that it might now with propriety make a similar provision for the inspection of quartz mines in the Territories. It could go no further.

Senator Teller plainly placed his opposition on the ground that the bureau would be of no real service. In the course of a long speech he said: "My objection to the bill is twofold: First, that it will be a great waste of money, an expenditure without return, and that it will be an absolute interference with the mining operations of this country, particularly with the mining of precious metals. * * * There is not in any section of the world men engaged in that industry who know any more about it than the miners of Colorado, Montana, Idaho, California and Utah. We do not need the fostering hand of the Government. We do not need any man to come from Washington out there to tell us how to develop our mines or, in the words of the bill, how to promote and develop the mining industries of the United States to make diligent investigations of the methods of mining, the safety of miners. Everybody who has lived in a mining country knows how to do that. If they did not know, my experience is that they could not get any relief from a bureau established here in Washington."

Although Senator Newlands interposed to assure Mr. Teller that numerous conventions of mining experts in the West had united in asking for the bill, the speaker only answered by the general charge that such conventions were not representative, and hence could not be trusted to interpret popular feeling.

It is intended to introduce the bill again at the next session of Congress and to make an effort to secure its early passage.

Tariff Revision Notes

SPECIAL CORRESPONDENCE

The manufacturers of ferro-alloys have suggested to the Ways and Means Committee a new draft of language which they wish to have inserted in the paragraph of the new tariff corresponding to paragraph 183 of the present tariff. The proposed language is also approved by General Appraiser Fischer, who has had particularly under his supervision the various questions concerning the importation of ferro-alloys. The proposed wording is as follows:

Paragraph 122. Strike out the word "ferrosilicon."

Paragraph 183. Insert the following words: "Chromium or chromium metal, tungsten, molybdenum, titanium, silicon, tantalum, ferrosilicon, ferrochrome or ferrochromium, ferrotungsten, ferromolybdenum, ferrotitanium, ferrovanadium, ferrotantalum, ferrophosphorus, ferroboron, and all other metals and alloys, all the foregoing crude or refined but unwrought, whether capable of being wrought or not, and whether produced in electric furnace or blast furnace or by chemical or other process, not otherwise specially provided for in this act,——ad valorem."

TOOL STEEL

In a detailed brief submitted to the Ways and Means Committee the Columbia Tool Steel Company, of Chicago Heights, Ill., demands that a duty be placed on all foreign tool steels sufficiently high to protect the American maker against unfair competition by inferior grades, and also to protect the buyer and direct his attention to the superior quality of American-made tool steels. The demand is made apropos of a brief filed some time ago by several firms in Boston in which reference is made to the fact that European steels can be duplicated or excelled in this country by half a dozen tool-steel makers selling at a lower price. The Columbia Tool Steel Company then says: "If it were possible for all tool steel entering the United States to be classified according to its quality as shown by analysis, there would be no need of a protective tariff. The traditions built up prior to the manufacture of tool steel in America still have such a strong hold among certain classes, that when a standard European make of steel fails to give results the workman invariably will take the blame on himself for not giving it the proper handling, whereas if a failure occurs with American steel it is always the steel that is at fault. . . . . This would be manifestly impossible, in addition to which the tool-steel consumer has no facilities for making chemical analysis."

BISMUTH ORES

A new tariff treatment of bismuth has been proposed to the Ways and Means Committee by the Monsanto Chemical Company, of St. Louis, Mo., which recommends that in connection with the duties on lead there shall be a change in the wording intended to meet the conditions of production of bismuth. The change proposed is as follows: "Lead bullion or base bullion containing 95 per centum lead or less—per pound on the lead contained therein. *Provided*, that in levying and collecting the duty on lead, duty shall also be levied and collected on any other dutiable material contained therein. *Provided*, that in no bullion containing bismuth shall such bismuth be dutiable unless such bismuth is equal to or exceeds 75 per centum of said bullion."

It is argued that should the revised wording be employed it "will have the effect of building up a new industry in this country at the expense of a foreign monopoly, which at the present time exists."

The Tennessee Merger

SPECIAL CORRESPONDENCE

The confidential report of the majority of the Senate Judiciary Committee relative to the question whether President Roosevelt was authorized to permit the merger between the United States Steel Corporation and the Tennessee Coal, Iron and Railroad Company has now become public. It shows that a majority of the committee who censured the President, based a considerable part of their argument upon the alleged fact that he allowed a monopoly to come into existence, and that this monopoly consisted in large part of a control of iron-ore deposits. The majority report says: "Another important factor entering into the potential capacity of the Tennessee company is the proximity of the iron ore, coal and limestone holdings to each other and to the plants, and the consequent saving of transportation charges." Referring then to the report of the National Conservation Commission, the majority report quotes the following: "The known supply of high-grade iron ores in the United States approximates 3,840,000,000 tons, which at the present increasing rate of consumption cannot be expected to last beyond the middle of the present century." The majority continue as follows: "If, then, the United States Steel Corporation now owns and controls 2,400,000,000 tons of high-grade iron ore, as has been estimated, it has 62½ per cent. of the total supply of the country. If this corporation acquired 700,000,000 tons of iron ore with the Tennessee company, it added to its then estimated holdings of 44 per cent. of the iron-ore supply 18½ per cent., giving it as stated control of 62½ per cent. of the iron-ore supply of the United States. The purchase of this 700,000,000 tons of iron ore from the Tennessee company, increasing the Steel Corporation's holdings of ore more than 40 per cent., created that future monopoly in ore and commanding position in trade to which Judge Gary testified before the Ways and Means Committee. The Steel Corporation, it is admitted, now practically controls the ultimate iron-ore supply of the United States."

Pulp for concentration on blanket and canvas tables is diluted to 7 water to 1 ore at the Giant mine, Rhodesia (*Journ.*, Chem., Met. and Min. Soc. of South Africa, Nov., 1908), in order to obtain maximum efficiency.

Lake Superior Iron Ore

Shipments of iron ore by rail from the Lake Superior region in 1908 have now been reported in full. They were 587,893 tons—against 975,959 in 1907—and make the total for the year 26,044,987 tons, or 38.5 per cent. less than in 1907. The all-rail shipments are chiefly from the Mesabi range to the Zenith furnace at Duluth, from the Newport and Hemlock mines to Mayville, from the Illinois and Mayville mines in Wisconsin to Chicago and Mayville and from some of the Cleveland Cliffs company's Marquette range mines to the charcoal furnaces of Michigan.

The shipments, as apportioned by ranges, were as follows, in long tons:

Range:	1907 Tons.	1907 PerCt.	1908 Tons.	1908 PerCt.
Marquette	4,388,073	10.4	2,414,632	9.3
Menominee	4,964,728	11.8	2,679,156	10.3
Gogebic	3,637,102	8.6	2,699,856	10.4
Vermillion	1,685,267	4.0	841,544	3.2
Mesabi	27,495,708	65.0	17,257,350	66.3
Baraboo	95,790	0.2	122,449	0.5
Total	42,266,668	100.0	26,014,987	100.0

The shipments do not include those from the Michipicoten range in Canada, which were 148,000 tons in 1908, all from the Helen mine.

On the old ranges the Gogebic shows a smaller proportional decrease than the others. The Vermillion range had the largest proportional decrease, which was chiefly due to the abandonment of the Chandler mine, which was the chief producer up to two years ago.

The larger productions on the Marquette range were 438,379 tons from the Cleveland Cliffs and 278,366 from the Hartford; on the Menominee, 391,620 tons from the Chapin, and 365,361 from the Pewabic. On the Gogebic the leading producers were the Norrie, with 773,243 and the Newport with 579,390 tons. The Vermillion had only one great shipper in 1908, the Pioneer, with 477,506 tons. The Mesabi leaders were the Hull-Rust, 2,026,683; the Burt, 1,460,998; the Fayal, 1,439,879; the Adams, 765,592; the Virginia, 661,329; and the Mahoning, 611,592 tons.

The Oliver Iron Mining Company—the mining department of the Steel Corporation—in 1908 shipped a total of 14,123,957 tons, or 54.3 per cent. of the total. Only a small part of this came from the Hill lands, though a good deal of development and exploration work was done there.

Notwithstanding the dull year, shipments were made from six new mines—one on the Marquette, two on the Menominee, and those on the Mesabi range. Shipments are also reported from four old mines, which had been closed for several years previously—two on the Menominee and one each on the Marquette and the Mesabi.

Records of the shipments of Lake Superior ore have been kept from the first, and it is possible to give a statement of the total production up to the end of 1908. The figures are as follows:

Range:	Year Opened.	Total Ore.	Per Ct.
Marquette	1859	87,660,506	21.5
Menominee	1877	66,320,369	16.3
Gogebic	1884	56,807,198	14.0
Vermillion	1884	27,626,970	6.8
Mesabi	1892	167,492,908	41.2
Baraboo	1892	797,868	0.2
Total		406,705,819	100.0

The Baraboo range in Wisconsin is included, although it does not adjoin any of the other ranges, because there is some evidence of its geological connection with the Gogebic deposits. The date for the first shipments from this range has been set back to 1892, owing to the inclusion this year of the Mayville mine, which had not previously been reported.

In all there were 162 shipping mines in 1908, of which 25 were on the Marquette range; 34 on the Menominee; 18 on the Gogebic; 6 on the Vermillion; 77 on the Mesabi; and 2 on the Baraboo range. In 1907 shipments were made from 179 mines.

Hydraulic Mining in California

SPECIAL CORRESPONDENCE

The great quantity of water which has fallen this year in California has favored the hydraulic miners. This particular branch of the gold-mining industry is now most active in the counties of Siskiyou and Trinity, on the northwestern coast of the State. In those sections, as well as in the counties of Humboldt and Del Norte, there is no restriction on hydraulic mining as there are no navigable rivers and most of the larger tributary streams empty into the Klamath river which carries the drainage into the Pacific ocean. These northern counties, however, are not as well equipped with general ditch systems as the more central mining counties of the State. In Nevada, Placer and other central hydraulic mining sections, extensive ditch and reservoir systems were devised and built before there were any restrictions laid upon hydraulic mining, and these systems still exist. In Siskiyou and Trinity, however, each mine has to provide its own water supply and there are few public ditches from which water may be purchased. In these counties there are large bodies of auriferous gravel which have never been mined for this reason. The ground is of little value without a water supply and considerable capital is usually necessary to furnish this. There are few very large hydraulic enterprises in those regions though there are numbers of small ones, each with its individual water supply. However, the largest hydraulic mine in the world—the La Grange near Weaverville—is operating in Trinity county.

Hydraulic mining in California is now receiving the attention of both the national Congress and the State Legislature. In Congress Mr. Englebright has introduced a bill, an abstract of which has been given in the JOURNAL. Its real purpose is to permit miners to let hydraulic débris pass into mountain gulches or streams, provided they remove an equal amount from any place designated by the engineers of the California Débris Commission and pay for said removal. That is, if a miner some hundreds of miles from a navigable stream, lets any tailings get into a stream, he is privileged, if he pays for it, to remove an equal amount from some part of the stream or tributary where it is navigable. In this way he might continue to mine and yet not add any volume to the débris already in the river. The Anti-Débris Association is opposed to this and has resolved to send telegrams to Washington urging the defeat of the bill. In the State Legislature, Caminetti has a bill which creates an advisory board to the State Department of Engineering, composed of men who have interest and experience in gravel-mining matters. The River Commission people already have such an advisory board. The board is to be given powers only to advise with, and make recommendations to, the State engineer and the California Débris Commission, on matters pertaining to hydraulic mining. The California Miners' Association has sent a special committee to Sacramento to urge the passage of the bill, and the Anti Débris Association has sent a similar committee to try and defeat the measure.

Canadian Iron Production

The total production of pig iron in Canada has been heretofore reported. The detailed figures, as collected by the American Iron and Steel Association are as follows, in long tons:

	1907.	1908.	Changes.
Foundry and forge	84,979	114,951	I. 29,972
Bessemer iron	164,910	112,811	D. 42,099
Basic iron	341,257	335,410	D. 5,847
Total	581.146	563,172	D. 17,974

The total decrease was 3.1 per cent. Basic iron was made in 1908 by four companies owning nine furnaces and bessemer pig by two companies owning three furnaces. The basic and bessemer iron was all made with coke. Canada has not made spiegeleisen or ferromanganese since 1899.

On Dec. 31, 1908, Canada had 16 completed furnaces, of which 10 were in blast and six were idle. One of the idle furnaces was being rebuilt. Of the total 13 usually use coke for fuel and three use charcoal. In addition one coke furnace was projected and two coke furnaces upon which work was suspended some time ago were partly erected.

During the first half of 1908 the total number of furnaces in Canada actually in blast for the whole or a part of the period was 14, of which 11 used coke and three charcoal. During the last half of the year the total number of active furnaces was 11, of which nine used coke and two charcoal.

Comparative Tests of Run-of-Mine and Briquetted Coal

After a series of tests in burning run-of-mine and briquetted coal on a locomotive and on a torpedo boat, Mr. Goss, the engineer who conducted the tests, gives the results as follows:

(1) The briquets made on the Government's machines have well withstood exposure to the weather and have suffered but little deterioration from handling. (2) In all classes of service involved by the experiments, the use of briquets in the place of natural coal appears to have increased the evaporative efficiency of the boilers tested. (3) The smoke produced has in no test been more dense with the briquets than with coal; on the contrary, in most tests the smoke density is said to have been less when briquets were used. (4) The use of briquets increases the facility with which an even fire over the whole area of the grate may be maintained. (5) In locomotive service the substitution of briquets for coal has resulted in a marked increase in efficiency, in an increase of boiler capacity, and in a decrease in the production of smoke. It has been especially noted that careful firing of briquets at terminals is effective in diminishing the amount of smoke produced. (6) In torpedo-boat service the substitution of briquets for coal improves the evaporative efficiency of the boiler. It does not appear to have affected favorably or otherwise the amount of smoke produced. The briquets used in this series of tests were of a form requiring considerable bunker capacity for their storage, but as the form of the briquet is a detail entirely within control, this objection need not apply to the use of the briquets in actual service.

Locomotive Tests

Many low-volatile coals, such as those mined in the vicinity of Johnstown, Cambria county, Penn., are semi-smokeless and therefore very desirable for use in locomotives at or near terminals; nevertheless, on account of their low evaporative efficiency, they have not been found altogether satisfactory when used as locomotive fuel. Their tendency to disintegrate rapidly on the grate during combustion causes large quantities of cinders and sparks of high calorific value to be discharged. These cinders accumulate in the smoke box of the locomotive, obstruct the draft on the fires, and reduce the capacity of the boiler. The investigation here reported, therefore, was undertaken to determine in what measure, if any, the process of briquetting will serve as a remedy for these defects and to discover the effect of the process on efficiency and capacity.

The coal selected for the tests was taken from a mine working the Lower Kittanning coal bed near Lloydell, Cambria county, Penn., on the South Fork branch of the Pennsylvania railroad. Its characteristics as a locomotive fuel were therefore well known. The Lloydell coal is a friable, low-volatile bituminous coal, and the carloads selected for the tests consisted of run-of-mine. The coal was exposed to the weather for 30 days on the way to the St. Louis testing plant, before being briquetted. It showed but little change due to this exposure except a decided increase in moisture, which, however, was eliminated in the briquetting process.

The binding material in all the briquets was water-gas pitch. This material was furnished at the briquetting plant of the United States Geological Survey, in St. Louis, at $9 per ton, or 0.45c. per pound. The least amount of binding material that would make perfect briquets was found to be 5 per cent. of the weight of the coal. The cost of the binder in one ton of the 5-per cent. briquets was therefore 45 cents.

The cost of briquetting, including all charges, is estimated to be about $1 per ton of briquets; that is, the briquetting added approximately $1 per ton to the cost of the coal. The briquets were made, however, in an experimental plant, and the price is for this reason probably not so low as if they had been made on a much larger scale. After the coal was made up into briquets it was returned to the locomotive testing plant at Altoona, Penn., for the tests.

To observe the effect on briquets of exposure to the weather, a number of the round and square briquets were placed on the roof of the testing plant. After four months of exposure for the round and three months for the square briquets, no change whatever from their original condition was noticed. They appeared to be entirely impervious to moisture and were still firm and hard.

The briquets were little affected by handling. They were loaded at St. Louis in open gondola cars and shipped to Altoona, where they were unloaded by hand and stacked. They were handled a third time in taking them to the firing platform of the test locomotive. After these three handlings they were still in good condition, very few were broken, and the amount of dust and small particles was practically negligible.

The results of the tests justify the following conclusions: (a) The evaporation per pound of fuel is greater for the briquetted Lloydell coal than for the same coal in its natural state. This advantage is maintained at all rates of evaporation. (b) The capacity of the boiler is considerably increased by the use of briquetted coal. (c) Briquetting appears to have little effect in reducing the quantity of cinders and sparks; the calorific value of these, however, is not as high in the briquetted as in the natural fuel. (d) The density of the smoke with the briquetted coal is much less than with the natural coal. (e) The percentage of binder in the briquet has little influence on smoke density. (f) The percentage of binder in the briquet has little influence on smoke density. (f) The percentage of binder for the range tested appears to have little or no influence on the evaporative efficiency. (g) The expense of briquetting under the conditions of the experiments adds about $1 per ton to the price of the fuel, an amount which does not seem to be warranted by the resulting increase in evaporative efficiency. (h) With careful firing, the briquets can be used at terminals with a considerable decrease in smoke. (i) The briquets appear to withstand exposure to the weather, and suffer little deterioration from handling.

Briquets made from Arkansas semi-anthracite, two qualities of Indian Territory slack, Indian Territory screenings, Missouri slack, Indiana Brazil block slack, coke breeze, and a mixture of coke breeze and washed Illinois coal were tested, and comparisons were drawn either with the same coal that was used in the briquet or with coal similar to it. In nearly every test the results reported show that the coal when burned in the form of briquets gives a higher evaporative efficiency than when burned in the natural state. For example, Indian Territory screenings give a boiler efficiency of 59 per cent., whereas briquets made from the same coal give an efficiency of 65 to 67 per cent. Decrease in smoke density, the elimination of objectionable clinkers, and an apparent decrease in the quantity of cinders and sparks are named as the chief reasons for this increased efficiency.

Australian Iron Bounties

The Australian Parliament at its latest session passed a bill for "the encouragement of manufactures," and regulations prepared under this act have been issued by the government. A bounty of 12s.—$2.88—per ton will be paid on pig iron made from Australian ore, the quantity to be 1000 tons or over; and the same amount on bar iron puddled from Australian pig, at least 250 tons in quantity; and on steel made from Australian iron, not less than 100 tons to be considered. Bounties of 10 per cent. on value—which apparently means current price—are to be paid for iron or steel sheets or plates, minimum 100 tons; steel or iron wire or wire netting, minimum 50 tons; iron or steel pipes and tubes, minimum 50 tons. All are to be made from Australian iron. The year for bounties is to begin May 1, and the total amount to be paid is limited to £180,000 in five years.

During the first 11 months of 1908, an average of 8981 stamps were dropping on the Rand, and the average duty per 24 hours per stamp was 6.21 tons.

Colliery Notes

To get maximum efficiency from your ventilation, split your air as near the fan as possible.

Pumps should be set as close to the sump or water supply as practicable, so that there is no danger of drowning the pump in case of an accident.

One mine foreman states that a good mixture of mortar for stoppings is made by taking one part of cement to about seven parts of fine coal dust.

When searching for an unexploded charge in material blown down, great care should be taken that the detonator be not struck with a pick or other tool.

When any quantity of coal at the face is supposed to contain a portion of an unexploded charge, and the explosive is not recoverable, the coal should be securely packed in the goaf.

The principal difficulty in the utilization of peat under boilers appears to be the frequency with which it is necessary to fire. This disadvantage is caused by the lightness of the material and also on account of its rapid combustion.

The mine foreman who persists in his assertion that it is better to always curse his men in order that the maximum effort may be obtained, is making the mistake of his life. Those miners who only answer to rough handling are exceptions, and any organization will prosper better without them.

If a general examination were held and all coal-mine managers and superintendents were asked to tell what they know concerning the laws that regulate coal mining in their respective States, it would be surprising what little time would be required by some of these officials in telling all they know.

The fireboss who makes his rounds at 3 a.m., aided only by the light of a dim safety lamp, has no easy task; for this reason, he should insist on the miners keeping their places safe and clear. When miners do not keep their places in a condition that permits easy travel, the fireboss should stop them from working until they clean up.

Any loose rock or dangerous top in a working place should be taken down immediately after it is discovered. Nothing is more important than that the miner should make his place safe, and when orders are given to pull down dangerous roof, or to put props under it, the miner who disobeys or delays should be punished.

It is stated on good authority that an economical plant ought to make peat fuel at 60c. per ton. This result is accomplished by first draining the water from the bog, and then using a dredge which can take up an entire section of peat, 12 to 14 ft. in depth, at one time. Recent tests have proved that a good quality of peat has a calorific value of 10,082 B.t.u. per pound.

As long as the cost of coal remains low, and freight charges moderate, the most promising field for the economic exploit of our vast peat lands lies mainly in the gasification of peat, and the utilization of its by-products, rather than the manufacture of briquets. In conjunction with such a plant, the making of peat mull and peat straw, are industries that may meet with success if conditions are favorable.

Since the miner's certificate is so easily obtained, would it not be a wise safety precaution for the mine foreman or an assistant to go with a new man who is about to start as a miner, and see how he goes about preparing his shots and putting his place in order. It would be a difficult matter for any man, not versed in the art of mining, to hide his incompetency from an experienced foreman. Should the applicant be found incapable, the mine foreman should either employ him as a laborer or refuse his services altogether.

Up to the present time, the many mechanical and electrical arrangements which have been designed to dry peat cheaply, have all proved commercial failures. The only economical drying agents so far discovered, are the wind and sun. Could some scheme be devised whereby peat could be produced as a fine powder for dust firing, the field of this fuel would rapidly attain importance. There are only four works in Europe that manufacture solid peat briquets, and not one of these establishments has proved a great commercial success.

Mine managers should investigate carefully before they employ foremen or superintendents who have a reputation for producing the so-called "cheap ton" of coal. Many of these men, who are so much sought after, have a habit of reducing expenses by mining all the easily available coal, without devoting time or attention to future economic and systematic development. Such men remain with one company but a short time, and usually make it a point to change about the time the output starts to decrease and the cost begins to increase.

In the year 1650, at a colliery in North Wales, the general plan was to employ a man to enter the mine and fire the gas before the miners went to work. This man, who was called a "fireman," was dressed heavily, with his outer clothes thoroughly soaked in water. He carried a cane on which a naked lamp was fixed; when a doubtful or dangerous place in the mine was reached, he would lay down on the floor, or in a ditch, and then raise his candle to the roof and fire the gas. The historian states further that the fireman was seldom hurt. If the plan followed in 1650 were to be adopted at some of our gaseous mines today, it is probable there would be a great scarcity of firemen.

If we assume the average depth of all the peat bogs in the world to be 7 ft., then for this depth, every square mile would yield $7 \times 112{,}000 = 784{,}000$ tons (2000 lb.) of air-dried peat, and the estimated 200,000 square miles of bogs represent 156,800,000,000 tons of stored fuel. Considering that the heating value of the peat will average 4000 cal. per kg., or 7200 B.t.u. per lb., this is equivalent to 94,080,000,000 tons of coal of 12,000 B.t.u. per lb., or less than 4 per cent. of the estimated coal resources of the United States. Basing our figures on the present consumption of coal and lignite, without considering a future increase, our peat deposits would last about 75 years. The peat bogs in the United States would be exhausted in about 35 years if utilized as the sole supply of solid fuel.

The question of tamping shot holes in mines has recently been subjected to considerable discussion by coal engineers. The experiments of an English investigator show that owing to its inertia and friction on the side of the hole, tamping offers greater resistance to the escape of gases than generally supposed. This same authority has found that in a 1-in. diameter hole, 2 oz. or 4 oz. of powder would not blow out more than 7 in. of clay tamping, and that when the blast breaks out its burden, such tamping is often found intact in the hole. For high explosives, the 12 or 18 in. of tamping often used is unnecessary, as a few inches would often be sufficient. Many experienced shot-firers claim that in general, it is sufficient to use a tamping of water, or that a few inches of clay or paper pushed tightly home is all that is required. It will be interesting to hear what other authorities have to say on this subject.

The Pennsylvania law requires that all men who propose to become miners in the anthracite mines, shall first serve two years as a miner's laborer, previous to their appearance before the miners' examining board to obtain a certificate, which credential is necessary to their employment as miners. The intention of this law is often frustrated by the deception practiced by foreign miners. When a foreign laborer has been employed at some of our mines for two or three months, it often occurs to him that if he could only secure a certificate, he could mine coal as well as the man he is working for. The general plan followed is to have one of his friends of the same nationality, appear before the miners' examining board, and after giving the name of the laborer who desires the certificate, the more experienced miner answers the dozen or more questions propounded, pays his $1.50 to the board, takes his certificate and sells the paper to his friend for the price agreed upon. Is it any wonder that mine accidents which so frequently occur, are often due to the ignorance of the miner himself?

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Illustrated.

The Situation in Copper

The statistics reported by the Copper Producers' Association last week for the month of February are not properly comparable on their face, with those for January because January was a long month and February a short one. Consequently, it is necessary to reduce to a daily basis. Upon such a basis it appears that the production in January averaged 3,617,265 lb. per day; in February, 3,703,600 lb. per day. This was a rather large increase; if maintained for a year it would amount to nearly 30,000,000 pounds.

The exports in January were 42,985,600 lb.; in February, 31,104,640 lb. Deducting these figures from the deliveries reported by the Association, it appears that American consumers in January took 47,376,821 lb., and in February, 43,441,974 lb. Computing the figures according to the working days in each month, the deliveries to domestic consumers in January averaged 1,822,185 lb., and in February 1,888,781 lb. So far as they go, these figures are encouraging, but they carry the metal only up to the gates of the manufacturers, and we do not know the situation inside of the latter. If we may assume that consumption is actually going on at the rate indicated for January and February, it must be recognized that there is a substantial improvement over the average for the whole of 1908, and that it is to Europe chiefly to which we must look for the great increase in demand to absorb the accumulating stock.

It was not to be supposed that production in February should exhibit a diminishing rate, inasmuch as the refineries were still working upon crude copper produced by the smelteries previous to Jan. 1. During February there was some curtailment by the miners who are unable to produce profitably on a 12½-cent basis, but even so it is doubtful whether their restriction is not more than offset by the increased production of Ely and other places that can produce profitably at a much lower figure. In this connection it is worth while to explain what is meant by cost of production. Sometimes the meaning is "direct operating cost." More conservatively, the meaning is the difference between gross proceeds and dividends to stockholders, which include all expenses for development, new construction, etc. Even so, the ultimate cost is an amount sufficiently large to reimburse the investment of capital. The allowance that should be made on the last account is difficult to determine for a variety of reasons. Moreover, in the curtailment of production there is a running expense on account of overhead charges which may make it cheaper to forego temporarily capital-return than to cease production entirely. Formerly, these conditions used not to be so carefully considered, but nowadays the talk that copper is cheap at about 12c. manifests not so much increased cost of production as compared with 10 years ago as it does the idea lurking in many minds that the capital invested in the production must receive an adequate return; in other words there is a better understanding of economics.

As to the outlook for copper in the immediate future, it is doubtful if the large sales that were made about March 1 help matters materially. Part of them were for speculative account, which does not assist at all; another part, representing the transactions with manufacturers, may not any more than make good the contracts that expired in February. It is quite obvious that there must be either a natural curtailment of production, or an increase in demand from home and abroad. Probably both those things will come into play and the market will naturally seek the level where demand and supply will balance.

Blast Roasting

Ever since the introduction of the Huntington-Heberlein, Savelsberg and Carmichael-Bradford processes there has been discussion as to the reason why they are so efficient in desulphurizing galena. Several years ago it was thought that lime played a chemical part in these processes, and ourselves leaning toward that belief we applied to them the generic name of "lime roasting." Later experience cast a great deal of doubt upon the chemical agency of lime, the function of the latter appearing to be to act as a diluent of the charge, and Prof. L. S. Austin introduced the name "pot-roasting" because the processes were then commonly performed in pots. Still later it developed that they could be done with other means, and A. S. Dwight used the term "blast-roasting." This will doubtless survive.

This progress in nomenclature marks the development in ideas as to these processes. Their results being so remarkable

in respect to rapidity and completeness of desulphurization and minimization of loss of lead and silver that it appeared to be necessary to attribute them to some undescribed chemical reaction. However, evidence gradually accumulated to show that there was nothing but an intensification of the ordinary reaction between sulphides and atmospheric oxygen, just as the combustion of coal on a grate is hastened by an under-grate blast, or indeed, the combustion of zinc sulphide (as in Bartlett kilns and the Greenawalt porous-hearth reverberatory). Indeed, we find the closest analogy in the blast furnace for smelting, which under certain conditions possesses a great oxidation-factor. Yet, the well known fact that the Carmichael-Bradford process, using gypsum, yields more sulphur dioxide than can be credited to the ore, has caused suspicion to remain that perhaps after all there is some reaction between lime, or lime sulphate, and the sulphides. So far as we were aware, calcium sulphate was not decomposed at the temperature believed to be attained in this process.

Prof. H. O. Hofman and W. Mostowitsch, in a paper in the *Bulletin* of the American Institute of Mining Engineers for January, 1909, report the results of an experimental investigation that clear up all doubts as to this matter. They have found that calcium sulphate begins to be decomposed at 1200 deg. C., but the dissociation is not complete until a much higher temperature is attained. However, silica begins to decompose $CaSO_4$ at 1000 deg. and the reaction is complete at 1250; while ferric oxide begins to decompose $CaSO_4$ at 1100 deg. and the decomposition is complete at 1250 deg., the product being calcium ferrite. The formation temperatures of calcium silicate and calcium ferrite are lower than their melting temperatures. Gypsum has no decomposing effect upon galena.

It is now established that in these processes the galena is oxidized by oxygen alone, but while the temperature in the ordinary oxidizing roast is but 900 to 1000 deg., in the blast roast it must be 1000 to 1250 deg. It has for a long time been recognized that the temperature of the latter roast is higher than would be implied by the low volatilization of lead, and it has been pointed out that the thermal action is localized as in the well-running blast furnace. However, although the older theories as to the formation of calcium plumbate, or other compounds, in these processes have had to be discarded, the results of Hofman and Mostowitsch support the notion that there was some chemical action other than mere atmospheric oxidation. Inasmuch as gypsum is not decomposed at 1000 deg., the temperature of ordinary roasting, its presence can but have the effect of increasing the percentage of sulphur in the roasted charge. But at slightly higher temperature two important reactions occur, although lead or zinc play no part in either, whereby desulphurization is completed.

Metallurgists owe a great deal to investigations of this character, such as are being carried on in the laboratories of the Massachusetts Institute of Technology, Columbia University, and other institutions. They are beginning to reduce our knowledge to the precise basis of physical and pyrometric measurements and are rapidly furnishing data upon which new practices will be based. This is a line of work upon which the colleges should more and more concentrate their attention.

Steel Making in the United States

The production of steel ingots and castings in the United States in 1908 was less by a little over 40 per cent. than that of 1907, the decline having been rather greater than that in pig iron. The make of steel in 1908 was the smallest reported since 1901, with the sole exception of 1904, when the total was only 130,321 tons less than last year. The total make in 1908 was 13,897,627 tons, of which only 6,116,755 tons were bessemer, or converter steel, 7,780,872 tons being made in the open-hearth furnace.

Aside from the great decrease, the notable feature in the year's production was that the falling off in bessemer output was proportionally much greater than in open-hearth, the result being that for the first time the latter formed the larger part of the steel made. The proportion of converter steel to the total in 1908 was 44 per cent., which compares with 50.2 in 1907, and with 72 per cent. 10 years ago. Moreover, the smallest loss was in the basic open-hearth process, so that last year acid steel was only 49 per cent. of the total and basic 51; the proportions in 1907 having been 55.7 and 44.3, while in 1898 they were 82.3 and 17.7 per cent. Divided according to the process used, the production of steel for 11 years past has been as follows, in long tons:

	Bessemer.		Acid Open-hearth.		Basic Open-hearth.	
	Tons.	PerCt.	Tons.	PerCt.	Tons.	PerCt.
1898.	6,609,017	74.8	660,880	7.5	1,569,412	17.7
1899.	7,586,354	72.0	866,890	8.2	2,080,426	19.8
1900.	6,684,770	66.3	853,044	8.5	2,545,091	25.2
1901.	8,713,302	65.2	1,037,316	7.8	3,618,993	27.0
1902.	9,138,363	61.6	1,191,196	8.0	4,496,533	30.4
1903.	8,592,829	59.6	1,094,998	7.6	4,734,913	32.8
1904.	7,859,140	57.1	801,799	5.8	5,106,937	37.1
1905.	10,941,375	55.0	1,155,648	5.8	7,815,728	39.2
1906.	12,275,830	52.8	1,321,653	5 7	9,658,760	41.5
1907.	11,667,549	50.2	1,269,773	5.5	10,279,315	44.3
1908.	6,116,755	44.0	696,304	5.0	7,084,568	51.0

Basic bessemer steel was never made in this country on a large scale, and has not been made at all since 1897. All the bessemer metal in the years given above was acid steel. In this table the small quantity of crucible and special steels, which has never reached 1 per cent. of the total, is disregarded. This production of crucible steel in 1907 was 145,309 tons; for 1908 it has not yet been reported, but probably did not exceed 110,000 tons. This would make the total output of steel for the year just over 14,000,000 tons.

The year 1909 may be expected to show a substantial increase over 1908, though there is now no probability—hardly even a possibility—that it will attain the high level of 1907. It is safe, however, to predict that there will be no great change in the proportions of the different classes of steel.

The preponderance of the open-hearth process may be expected to continue permanently, since it is based on the actual substitution of one process for the other, and not on any temporary condition. Thus, for instance, the steel made in the great new works at Gary will all come from open-hearth furnaces; and such furnaces have lately replaced an important group of converters in the Carnegie works at Pittsburg. The bessemer converter has had an important part in industrial history, but it is gradually giving way to its later rival.

THAT CONCESSIONS IN price do really stimulate consumption is illustrated by the recent experience of the American Radiator Company, which in 1908 realized the largest profit in its history. In their annual report the directors state that the lower selling prices established, because of reduction in cost of raw materials, induced a great number of people to purchase products for introduction in old buildings, and business from that source was largely increased.

The Anthracite Position

At the conference held in Philadelphia, March 11, there were present representatives of all the anthracite companies, headed by George F. Baer, president of the Philadelphia & Reading, and the United Mine Workers' committee, headed by President Lewis. The operators rejected all of the miners' demands. They also made a definite counter proposition to renew the present agreement for a term of three years, as in 1906. This means that the United Mine Workers must sign such an agreement before the existing agreement expires, on March 31, or take action upon the question of suspending work in all the collieries of the anthracite region. An official statement given out by Mr. Baer is as follows: "A committee of seven representatives of the Anthracite Mine Workers and a committee of seven representatives of the anthracite operators held a joint meeting to discuss the mine workers' demands. These demands are the same that were drafted in Scranton last October.

"The operators declined to accede to the demands. The chief reason offered for the rejection was that any increase in the cost of production would necessitate an advance in the price of coal, and that such an advance was impracticable. The operators said that the wages in the anthracite mining industry were already at a high level and could not be increased.

"The announcement of the operators' position was followed by a free discussion of the various demands, each side stating its views fully in regard thereto. The operators declared their unwillingness to reopen the eight-hour-day question and other questions passed upon by the Anthracite Strike Commission of 1902. They also declared themselves opposed to the mine workers' proposition for a one-year agreement.

"They declined to recognize the United Mine Workers of America, chiefly on the ground that it was controlled by bituminous mine workers. They said they met Mr. Lewis and his committee as representatives of the anthracite mine workers and not as officers of the union. The operators called upon the report of the Strike Commission to support their refusal to deal with the United Mine Workers.

"At the end of the discussion the operators made the definite proposition to renew the present agreement for a term of three years."

A second conference held on March 12 had the same result, and the committees adjourned with the understanding that another conference would be held after President Lewis, of the United Mine Workers, and his committee had presented the operators' proposition to continue the existing agreement for another term of three years to a convention of the mine workers.

Accordingly a convention of representatives of the miners in the three districts in the anthracite region has been called, to meet at Scranton, Penn., on March 23. All further conferences are adjourned until after this meeting.

It will be seen that the differences are wide. The operators declare that they are entirely uncertain as to the result, but they are determined not to give way, and not to surrender the open-shop principle, which has been the rule for three years. So far as trade is concerned, the season is approaching when domestic demand is light, and there are heavy stocks on hand, which will supply the trade for some time. Stocks of steam sizes are small, and a suspension would throw a large part of this trade to bituminous coal. Upon the whole, the conditions favor the operators, and they have on their side the support of the public, which cannot see the reason of the miners' demands, and is in no humor to submit to increased prices for coal.

The New Tariff as Proposed

The bill brought in by the Ways and Means Committee on March 17 makes the following changes:

Item.	Present.	Proposed.
Asphaltum, crude	free	$3.00 per ton.
Fluorspar, crude	10%	0.50 per ton.
Fluorspar, refined	20%	1.75 per ton.
Boric acid	5c. per lb.	2c. per lb.
Borax	5c. per lb.	2c. per lb.
Bauxite, refined	0.6c. per lb.	0.5 c. per lb.
Ammonium sulphate	0.3c. per lb.	free
Alum	0.5c. per lb.	0.25c. per lb.
Soda ash	¾c. per lb.	0.25c. per lb.
Sodium nitrate	2½c. per lb.	2c. per lb.
Salt cake	$1.25 per ton.	$1.00 per ton.
Sulphur, refined	8.00 per ton.	6.00 per ton.
Gypsum, crude	0.50 per ton.	0.40 per ton.
Gypsum, calcined	2.25 per ton.	1.75 per ton.
Iron ore	0.40 per ton.	free
Pig iron	4.00 per ton.	$2.50 per ton.
Bar iron	0.6c. per lb.	0.4c. per lb.
Steel rails	7/10c. per lb.	4/10c. per lb.
Aluminum	8c. per lb.	7c. per lb.
Lead in ore	1½c. per lb.	1c. per lb.
Lead bullion	2½c. per lb.	1¼c. per lb.
Monazite sand	6c. per lb.	4c. per lb.
Spelter	1½c. per lb.	1c. per lb.
Sheet zinc	2c. per lb.	1¼c. per lb.
Zinc in ore	free	1c. per lb.

Refrigeration Applied to Mining

The application of mechanical refrigeration to mining operations, shaft sinking, etc., has been practiced (*Mining Science,* Dec. 10, 1908) in Europe for the last 25 years. In America, however, although well known, it has been little practiced, compressed-air methods being more favored. For instance, in 1906 there were about 56 shafts sunk in other countries by this method, while in America there was only one.

The field for this system of operation is much the same as that of the compressed-air method, i.e., working through quicksand or strata of gravel impregnated with water. Each system, of course, has its special advantages and adaptabilities. For instance, the compressed-air method is superior for laying foundations under water by the caisson system, or for penetrating impregnated strata where rapidly flowing water is encountered which would tend to carry away partially frozen material. On the other hand the refrigeration method is better adapted for working to depths where compressed air may not be efficiently used on account of the injurious effect of the pressure upon workmen. With high pressures used in working to considerable depths frequent changes of shifts are necessary and much time is lost. In such cases the ventilation is liable to be unsatisfactory, leakage enters as a large factor of loss and the danger of a serious blow-out must always be faced.

In Europe the refrigeration method is mostly used in sinking in coal, iron and salt mines. In salt mining it is least efficient owing to the fact that the water impreguated with brine necessitates exceedingly low temperatures to produce freezing.

Methods of Working

The methods of operation practiced are modifications of the Poetsch system. In one system employed small holes are sunk around the periphery of a circle to inclose the proposed shaft. In each of these holes two pipes are lowered. The larger is closed at the bottom and into this the shorter one, open at the bottom, is lowered. The original lining of the holes is then drawn, the pipes connected, the outer to the brine or ammonia supply and the inner to the exhaust. Freezing of the surrounding material is then effected and the shaft is carried down within the inclosed circle. Afterward steam or hot brine is turned in the pipes to thaw out the ground and to facilitate their removal. The great disadvantage of this system is that, as with a diamond drill, the pipes sometimes depart from the desired direction entering the proposed course of the shaft.

Another development of this same system is in many cases more desirable. Shorter lengths of pipe are used connected by flexible joints with a central receiving head divided into two chambers, one the supply connected with the outer pipes, the other the exhaust connected with the inner pipes. The refrigerating material in circulating through the system freezes the surrounding ground. The core is excavated, lining inserted between the tubes and the lining completed while the tubes are again sunk to their full length. The points of variance between this and the first case are in the fact that the work progresses in stages and that a removable receiving head is used; thus shorter lengths of pipe are required and the danger of their deflection is reduced.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

A Novel Stadia Rod

Mr. Granbery's article in the JOURNAL of Feb. 27, 1909, on stadia measurements recalls some work I did in the '70s, using stadia measurements in running several thousand miles of lines to make a topographical map of several hundred square miles. My rod was made in 7-ft. lengths, jointed, feet marked in black, and tenths painted alternately red and white, the rod being 3x¾ in. I forget who told me to use looking-glasses, but I had pieces of looking-glass cut 0.1 ft. long and inserted them in the rod in the 0.9-ft. mark, the number being painted above the foot mark. With an intelligent rodman any distance for which the rod was long enough could be measured without trouble.

A "kink" I worked out proved a great time-saver in the field, and with care was just as accurate as the vertical-angle calculation for difference in elevation. It was as follows: After reading the distance on the rod and recording the vertical angle, bring the telescope level, note with the eye a piece of dirt, branch, or any object that the middle cross-hair cuts, bring the lower cross-hair up to this object, note by eye the point where the upper cross-hair cuts, screw up the telescope until the lower cross-hair cuts this new point, continue this until the upper cross-hair cuts the rod, note the reading on the rod of the upper cross-hair, then the difference of elevation is the stadia reading multiplied by the number of times the telescope has been moved up less the reading of the top cross-hair.

Thus, suppose stadia reading is 7 ft. = 700 ft. distance, that the telescope has been moved up eight times and then the top cross-hair cuts the rod at 4 ft., then

$$7 \times 8 - 4 = 52 \text{ ft.} =$$

hight of bottom of rod above instrument. If the rod is lower than the instrument, bring telescope level, work down until bottom cross-hair cuts rod and add this reading. Thus, distance as before, but lower cross-hair cuts rod at 16-ft. mark; then

$$7 \times 8 + 16 = 72 \text{ ft.} =$$

hight of bottom of rod below instrument.

In plotting topography in the field this will be found much the quickest way to get the difference in elevation, and it is also a check on the vertical angles. There are times, of course, when it cannot be used, as when the level line cuts above the sky line, or when a grain field is cut by the cross-hairs. With good points to look at I found it to check up on the vertical-angle readings and only calculated vertical angles at night or on rainy days to check up the work. The only way to take topography with stadia is to plot the contours in the field; everything that saves time helps.

Another pointer for the beginner is: In taking vertical angles, sight at any convenient foot mark on the rod, record the vertical angle and under it put the foot mark with the prefix + or —, depending upon whether the rod is lower or higher than the instrument; thus, vertical + 5 deg. — 3 ft., or — 10 deg. + 6 ft.; the 5-deg. angle was taken to the 3-ft. mark and the 10-deg. to the 6-ft. mark on the rod; these feet to be added or subtracted from the calculated elevation.

Two good men in clear country should easily run 10 miles a day of stadia lines and put in the topography. A good rodman, however, is essential. I think Mr. Granberry's rod would be improved by inserting looking-glass at every foot mark. I do not see the necessity for the fine markings; tenths of a foot, I think, are are all that are required except for quite short sights.

R. H. SANDERS.

Philadelphia, Penn., March 10, 1909.

Diamond Mine in Pike County, Arkansas

The letter appearing in the JOURNAL of Feb. 13, 1909, under the above heading and written by Dr. John C. Branner, from Stanford University, Cal., in criticism of my article on an "Arkansas Diamond Mine," which appeared in the JOURNAL of Jan. 16, 1909, seems to require an answer from me.

Taking Doctor Branner's criticisms in the order in which they are written, it appears that the fundamental trouble with my article lies in the unfortunate statement that Doctor Branner scouted the idea of the igneous mass containing diamonds. This, Doctor Branner admits to be true in his letter, but explains that he did so deliberately to keep people of Arkansas from going crazy.

The fact that I attributed Doctor Branner's skepticism (for in the absence of his letter of explanation it can be taken as nothing else) to a wrong reason, which Doctor Branner corrects by the true quotation from his own report, seems to me to refute his accusation of my having repeated most of his geology, for had I done so, I certainly would have made no mistakes and would certainly have given him full credit for same, as was done in the case of other authorities quoted in the article.

I first visited the Arkansas diamond field in June, 1908, for the purpose of making a report on same. While in Little Rock, the president of the Arkansas Diamond Company showed to me a copy of the report of the Arkansas Geological Survey containing Doctor Branner's and Doctor Brackett's reports and descriptions of the igneous area. I read these reports through hurriedly and glanced at the appended map, this being the only time I had seen the report or, to my knowledge, the map, until after the publication of Doctor Branner's letter.

As full geological reports had already been made by competent geologists in the employ of the Arkansas Diamond Company and others, and I had been employed to report on the engineering and economic possibilities of the field, the geological features were not of as much interest to me at that time as they might otherwise have been.

In regard to the geological portion of my article, the only part of it that was not written from my own personal field observations is the paragraph relating to the inclosing or country rock of the igneous area. This information was pieced together from several different reports and articles on the region, and it would have been difficult to give credit to any one of them, and was, therefore, published as general information. These reports may have been partly or wholly based on Doctor Branner's report.

As to the map in question, Doctor Branner certainly has justification for his claim. This map was given to me by the Arkansas Diamond Company with the information that it had been made by persons in their employ, which is absolutely correct, except that no mention was made of the fact that the volcanic outline, as determined by Doctor Branner, together with Doctor Branner's geological key, had been traced on the map to show the relative position of the area as determined by Doctor Branner and as determined by their survey. This fact I was not aware of until after the publication of Doctor Branner's letter, when I procured as soon as possible a copy of Doctor Branner's report and map and checked up both carefully. I am very sorry that the map was published without due acknowledgment

to Doctor Branner and hope that he will accept my apology for having done so.

In regard to my footnote relative to not finding diamonds in the *true matrix* in South America, I will leave that question to specialists in geology to fight out among themselves. A similar footnote or reference will be found, I believe, in *The Mineral Industry* for 1907. A discussion on this subject would prove interesting.

In conclusion, I beg to assure Doctor Branner that I had no such childish intent—appearances from his viewpoint to the contrary—to elect him "IT," nor do I pose as the "one gallus" man who first realized the possibilities.

JOHN T. FULLER.

Murfreesboro, Ark., March 1, 1909.

Firing Shots from the Electrical Power Service

D. Harrington's interesting account in the JOURNAL of the system of firing shots by electricity at the Utah Fuel Company's collieries, reminds me of the experiments that were carried out in the United Kingdom in the early days of electric lighting. In those days the electrical pressures did not exceed 110 volts and many things could be done with impunity that would not be practicable in these days, when pressures of 3000 volts are employed underground in collieries.

At the collieries where the system was carried out, an iron wire was connected to the end of one of the electric-light cables, and was carried into the workings, upon earthenware insulators. To fire a shot, one of the fuse wires was connected to this iron wire, and the other wire was pushed into the shot hole. In those days there was usually sufficient "earth" or "ground," as it is so much more expressively called in America, to complete the circuit through the fuse, when a switch, placed in any convenient position, and inserted in the iron wire, was closed. In addition to this, at one of the collieries, at least, where shot firing from the electric-lighting service was carried out, the electric engine-plane signals were also worked from the lighting service.

So far as I know, no serious accidents took place, but in Yorkshire, where it was tried, there were complaints of serious shocks being received from the rails, at some distance from the shot holes. In the collieries where the signals were worked from the electric-lighting service, it was very common to see flashes of light, similar to those one sees between the wheels of a tram car and the rails, at different parts of the engine-plane roads, produced by broken signal wires making contact with the rails, and then being pulled out of contact.

The arrangement described by Mr. Harrington avoids a large number of difficulties inherent to any method of firing shots, or working signals from the power service. The precaution of disconnecting the shot-firing service from the generator, at all times except at the instant of firing, is exceptionally good. It insures, if the regulation is carried out, that the shot firing service itself cannot give shocks as long as its insulation is perfect. The provision also, of switches controlling the different branches, and still more, locking the switch cases, so that they cannot be interfered with, is of great value.

There is one danger, however, remaining, and that is the possibility of the shot-firing service cables making contact either directly with the power-service cables, or with some other metal which is in contact with the power-service cables, and transmitting the killing pressure to some other innocent body of metal, nearer the face. This difficulty should be largely overcome, and apparently from Mr. Harrington's report of the absence of accidents, has been entirely overcome, by the careful system of inspection which has been adopted.

There is another point that I think should be mentioned. Already, even in main roads, there is difficulty in finding room for the cables necessary for distributing the power current, so as to insure them against accident. I am afraid that it would be still more difficult in the majority of cases, to find room for the shot-firing service cables, though it appears to me that the arrangement, if carried out, would be a very good one.

SYDNEY F. WALKER.

Bath, England, Feb. 20, 1909.

Tariff Notes

SPECIAL CORRESPONDENCE

A large number of additional briefs dealing with the duties on minerals and metals to be fixed in the forthcoming tariff bill have been filed with the House Ways and Means Committee. Among these are a lengthy argument from the Cleveland-Cliffs Iron Company, Cleveland, Ohio, submitting data regarding the cost of iron-ore production. According to this statement, the costs at points of delivery are as follows: At Lake Erie ports, $3.06; Mahoning and Shenango valley points, $3.71; Pittsburg and vicinity, $4.11; western Pennsylvania points other than above, $4.31; points east of the Alleghenies, $4.56. From these figures the inference is drawn that any reduction in the tariff on iron ore should be made with extreme conservatism.

IRON AND STEEL

Briefs filed by pig-iron interests in Pennsylvania and Virginia are to the effect that any reduction in the tariff on pig iron will be disastrous, one concern—the Thomas Iron Company, of Easton, Penn.—asserting that any serious change will eventually compel all manufacturers of merchant pig iron in the East to go into liquidation.

James Lord, president of the American Iron and Steel Refining Company, has submitted estimates of the cost of manufacturing refined bar iron. The cost of material is placed at $23.75, and the cost of conversion—including labor, taxes, insurance, depreciation and replacement—at $9.35, or, in all, $33.10 per ton.

Powell Stackhouse, president of the Cambria Steel Company, submits a statement showing the cost of steel rails to his company. This is $14.92 per ton for all purchased materials, supplies, ores, transportation, etc.; $9.42 for labor in mining and manufacturing; administrative and selling expenses of about 56c. per ton; or in all, $24.90 per ton.

LEAD

In a lengthy argument before the Ways and Means Committee, Vice-President Brush, of the American Smelting and Refining Company has undertaken to rebut the contentions of manufacturers of lead articles and others who are dissatisfied with the existing trade situation. Mr. Brush urges the retention of the duty of 1½c. per lb. on lead in ore, giving a protection of $30 per ton. He argues that, were there to be a cut in the tariff, the effect would be to discourage not only lead mining in the Rocky mountain region, but all other mining as well. The precious metals, he points out, cannot be recovered from the refractory ores of the Rocky mountains except as lead is used as a base to collect the precious metals in the process of smelting. In this process there must be at least 10 per cent. of lead in the furnace charge. Thus, according to this argument the whole business of the Rocky mountain region would suffer from such a change in tariff duties as is referred to. Mr. Brush further sets forth that the present price of 4c. per lb. for lead is not exorbitant, as is charged by critics, inasmuch as the cost of production in this country, not taking into account the depreciation of the mine, is approximately 3½c. As regards the alleged bad treatment of the mining interests by the smelters, it is set forth that the contracts with the miners agree to pay the latter the market price for their lead, silver and copper the day that it is shipped. Hence, it is argued, the claim that the smelting company profits by manipulating the price of raw material must be without foundation. It is denied that there is general community of the lead interests through joint directorates or common ownership of stock as has been charged.

The great lowering in costs that has been lately so conspicuous on the Rand, South Africa, has been due mainly to improved efficiency in the labor.

New Publications

ELEKTROLYTISCHE ZAEHLER. By Konrad Norden. Pp. 166; illustrated. 7x10 in.; paper, 9 marks. Halle a.S., 1908: Wilhelm Knapp.

PHYSIKALISCHE CHEMIE DER METALLE. By Rudolf Schenck. Pp. 193, illustrated. 7x10½ in.; paper, 7 marks. Halle, a. S., 1909: Wilhelm Knapp.

YEAR-BOOK OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, 1909. Pp. 350. 6x9¼ in.; cloth. New York, 1909: Published by the Institute.

ARTIFICIAL WATERWAYS AND COMMERCIAL DEVELOPMENT. By A. Barton Hepburn. Pp. 115. 5x8 in.; cloth, $1. New York, 1909: The Macmillan Company.

COMMISSION D'ENQUETE SUR LAS DUREE DU TRAVAIL DANS LES MINES DE HOUILLE. Rapport Final. Pp. 33. 8½x11 in.; paper. Bruxelles, 1908: Goemaere.

THE PORTLAND CEMENT INDUSTRY FROM A FINANCIAL STANDPOINT. By Edwin C. Eckel. Pp. 93; illustrated. 6x9¼ in.; cloth, $2. New York, 1908: Moody's Magazine.

ANNUAL REPORT OF THE BOARD OF REGENTS OF THE SMITHSONIAN INSTITUTION, 1907. Pp. 726; illustrated. 6x9 in.; cloth. Washington, 1908: Government Printing Office.

GEOLOGY OF THE TAYLORSVILLE REGION, CALIFORNIA. By J. S. Diller. U. S. Geological Survey, Bull. No. 353. Pp. 128; illustrated. 6x9 in.; paper. Washington, 1908: Government Printing Office.

THE LIME AND CEMENT RESOURCES OF MISSOURI. Volume VI, Second Series. By H. A. Buehler. Pp. 255; illustrated. 7x10½ in.; cloth. Jefferson City, 1908: Missouri Bureau of Geology and Mines.

HYDRAULIC TABLES. Second edition, revised. By Gardner S. Williams and Allen Hazen. Pp. 104; illustrated. 6x9¼ in.; cloth, $1.50. New York, 1909: John Wiley & Sons. London, Chapman & Hall, Ltd.

THE JOURNAL OF THE IRON AND STEEL INSTITUTE. Vol. LXXVIII, No. III. Edited by L. P. Sidney. Pp. 738; illustrated. 5½x8½in.; cloth. New York, 1908: Spon & Chamberlain; London, E. & F. N. Spon, Ltd.

CLONCURRY COPPER MINING DISTRICT, PARTS I AND II. By Lionel C. Ball. Queensland Geological Survey, Publication No. 215. Pp. 42-379; illustrated. 6x10 in.; paper. Brisbane, 1908: Government Printer.

THE GEOLOGY AND MINERAL RESOURCES OF NEW BRUNSWICK. By R. W. Ells. Canada Department of Mines, Geological Survey Branch. Pp. 135; illustrated. 7x10 in.; paper. Ottawa, 1907: Printed by S. E. Dawson.

ROAD MATERIALS OF SOUTHERN AND EASTERN MAINE. By Henry Leighton and Edson S. Bastin. U. S. Department of Agriculture, Bull. No. 33; pp. 56; illustrated. 6x9 in.; paper. Washington, 1908: Government Printing Office.

THE GEOLOGY OF THE PERSIAN GULF AND THE ADJOINING PORTIONS OF PERSIA AND ARABIA. By C. E. Pilgrim. Memoirs of the Geological Survey of India, Volume XXXIV, Part 4. Pp. 177; illustrated. 7x10½-in.; paper, 5s. 4d. Calcutta, 1908: Geological Survey of India.

TEXT-BOOK OF PETROLOGY. Fifth Edition, Revised. By F. H. Hatch. Pp. 404; illustrated. 5x7½ in.; cloth, $2.80 New York, 1909: The Macmillan Company; London, Swan Sonnenschein & Co., Ltd.

Contents: The physical characters of the igneous rocks. The constituent minerals of the igneous rocks. The classification of the igneous rocks. The distribution of the igneous rocks as illustrated by the British Isles.

MINERAL RESOURCES OF THE UNITED STATES, CALENDAR YEAR, 1907. Part I, Metallic Products. Part II, Nonmetallic Products. Pp. 743 + 897; illustrated. 6x9 in.; cloth. Washington, 1908: Government Printing Office.

This book is more clumsy than heretofore for having been divided into two volumes. This is done in accordance with an act of Congress. Why Congress should have made such a prescription, or bothered itself about the matter, is beyond comprehension. However, the ways and reasonings of Congress are "things that no fellow can find out," as Lord Dundreary used to say.

The book and the investigation of which it is the result cost the people of the United States about $75,000. If it were not that the U. S. Geological Survey is able to stretch its organic law to cover almost everything under the sun, we should ask the director to explain under what guise of legality the public funds are spent on reports as to the mineral resources of foreign countries and diverse other matters.

MAGNETIC DEPOSITS OF THE CORNWALL TYPE IN PENNSYLVANIA. By Arthur C. Spencer. U. S. Geological Survey, Bull. No. 359. Pp. 102; illustrated. 6x9 in.; paper. Washington, 1908: Government Printing Office.

This is a record of recent work in an old district, the object of which was chiefly to ascertain new facts bearing on the origin of the ore deposits. The results, so far as this object is concerned, were rather disappointing, but the author has been enabled to give a good description of an interesting group of mines. The orebodies occur in masses at different points on a rather wide belt extending from the Delaware river west and south across Pennsylvania to the Maryland line. The ores are generally magnetite, with enough pyrite to make roasting necessary. The largest and best known orebody is at Cornwall; it has been worked over 100 years, and is stilll exploited on a large scale. Smaller bodies have been, and are still worked at Boyertown, Joanna, Fritztown, Warwick and Dillsburg, all having nearly the same character.

INDUSTRIE DES METAUX SECONDAIRES ET DES TERRES RARES. By Paul Nicolardot. Pp. 435; illustrated. 4¾x7 in.; cloth, 5 francs. Paris, 1908: Octave Doin.

The plan of this little book is to take up each of the secondary metals having industrial applications, and to give for each its discovery, distribution, preparation, properties, alloys, extraction, detection and estimation, products and use in the industries. The book contains an introduction dealing with the preparation of alloys of the secondary metals by the alumino-thermic process and in the electric furnace, and the preparation of filaments for incandescent lamps. The metals are then treated in the following order: tungsten, molybdenum, vanadium, titanium, uranium, zirconium, yttrium, thorium, cerium, osmium, columbium and tantalum. Following is the appended matter, consisting of a list of the minerals referred to in the work, a bibliographic index, an index to the authors and subjects treated, and a systematic table of the contents.

The work contains considerable valuable information, such as could only be obtained by a search through recent chemical literature, and, for this reason, is to be recommended to the commercial or practical man. However, some important omissions are noted. The processes of Gin are not mentioned, and beryllium, the oxide of which is used extensively in the gas mantle industry, is omitted, as well as iridium. The historical discussions, although not presenting other than well-known facts, are commendable. Contrary to the custom of most continental chemists, Nicolardot properly refers to the element discovered by Hatchett as columbium.

Several minor typographical errors, fortunately unimportant, are noted. The arrangement of the references in an "index bibliographique," and not at the bottom of each page as they occur, is productive of some confusion and loss of time; but the comprehensive, yet condensed text, written in scholarly manner by an authority in mineral chemistry and metallurgy, renders the work so valuable that one forgets these lesser faults.

The National Conservation Conference

SPECIAL CORRESPONDENCE

March 5, the joint conservation committee provided for by the National Conservation Conference, which met some time ago, convened in Washington and began work in executive session. The committee as appointed by Chairman Pinchot includes (in addition to Mr. Pinchot himself) six members of State conservation commissions and three members of the National Conservation Commission. Representing the State commissions were J H. Teal, Portland, Ore.; Paris Gibson, Great Falls, Mont.; W. K. Kavanaugh, St. Louis, Mo.; Frank Rane, Boston, Mass.; O. J. Salisbury, Salt Lake City, Utah, and W. H. Milton, Marianna, Fla. The National commission is represented by Senator Knute Nelson, Alexandria, Minn.; Newton C. Blanchard, Shreveport, La., and George C. Pardee, Oakland, Cal.

To this committee reports were transmitted giving the details of the work accomplished by the State commissions and other organizations of similar character. The committee began by attempting to condense these reports and to draw from them practical suggestions as to what can be done in the way of coöperation between the conservation movements in the several States. The final recommendations will be transmitted by the conference to the several governors and the President, and these officers will be urged to do what they can to secure united action of all organizations concerned with the conservation of natural resources.

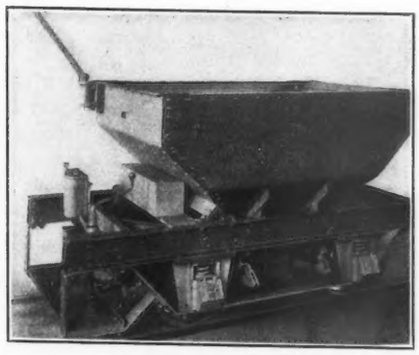
Among other documents which are before the committee for its use are those growing out of the resolution adopted by the conservation conference upon the suggestion of Powell Evans, of Pennsylvania, who presented a resolution providing that members of the national organizations in attendance upon the meeting be invited to offer their advice as to how the movement could be made practical.

A Bottom-Delivery, Electric, Charging Car

The accompanying illustration shows a type of car in use in a number of the largest smelters and concentrators, known as the Atlas center-dump, swinging-door design. The door swings outward and is operated by the lever adjacent to the operator on the platform. The sides and ends are steep so that the material will not adhere, thus giving a clean delivery at all times.

The wheels are made of special material to withstand the hardest work, and are ground to insure maximum adhesion. The bearings are dust proof and packed with waste. The brakes are of the standard street-car, inclosed ratchet handle type.

The electrical apparatus consists of a Westinghouse No. 64 motor, with type R controller, inclosed resistance, circuit breaker and cut-out switch, and reversible spring-type trolley. The cut-out switch is operated from the platform, and when the operator leaves the platform the current is cut off. This is for safety and avoids accidents, particularly as these cars are operated under very close clearance conditions. The wiring is specially incased in water-tight conduits to protect against the gritty material, which sometimes wears



ATLAS BOTTOM-DELIVERY, ELECTRIC, CHARGING CAR

the insulation. The cars have a capacity of 5 tons and run on a 36-in. track. The over-all length is 11 ft., the width 5 ft., and the hight from top of rail to top of car 5 ft. 6 inches.

The cars are manufactured by the Atlas Car and Manufacturing Company, Cleveland, Ohio, and the electrical equipment by the Westinghouse Electric and Manufacturing Company, Pittsburg, Penn. They are now in use at such smelters as those of the Garfield Smelting Company, Garfield, Utah; Michigan Smelting Company, Houghton, Mich., and the Anaconda Copper Mining Company, Anaconda, Montana.

Geological Survey Appropriations

SPECIAL CORRESPONDENCE

In the session of Congress which closed March 4, appropriations for the Geological Survey turned out more favorably than was expected at one point in the progress of the bills. The general current allowances have, of course, been maintained, but certain special changes have occurred, as follows:

1. A reduction of $150,000 in the fuel-testing appropriations of the Survey. This cuts the amount from $250,000, the sum set aside last year, to $100,000 for the coming year. Inasmuch, however, as it was expected that this appropriation would last only for one year on any basis, the allowance of $100,000 is regarded as an addition to, rather than a deduction from, the original appropriation.

2. An increase in the appropriation for topographic surveys to $350,000. This has stood at $300,000 during the past two years, but was $350,000 during 1906 and 1907. The increase for the coming year is thus $50,000.

3. An omission of the $10,000 heretofore granted for palaeontological investigations.

4. A transfer of the palaeontological work to the division of geological surveys. The latter appropriation is, however, increased by $25,000, raising it to $225,000 instead of $200,000, the figure for the past four years. Thus a net increase of $15,000 has occurred on palaeontology and geologic surveys taken together.

5. An increase of $10,000 in the appropriation for the investigation of the mineral resources of Alaska making this $90,000 instead of $80,000, the figure for the past five years.

6. An addition of $2500 to the annual rent allowances for the Survey. This permits an enlargement in the annex, which will be sufficient to allow the transfer of photographic laboratory of the Survey. This change is believed to be in the interest of more efficient safeguards against fire. At the same time it is held to furnish another argument in favor of the construction of a new building, inasmuch as every addition to the annual rent bill increases the economy to be realized by a new building. As to the building itself some progress has been made, although no favorable action was taken by Congress as a whole. The most that was accomplished was to get a favorable report from the House Committee on Public Buildings and Grounds. With another session's work the more hopeful friends of the Survey think that the desired provision can be pushed through Congress. In the course of the agitation in behalf of the bill its supporters received far more pledges of assistance than at any time in the past.

Correction

On page 399 of the JOURNAL of Feb. 20, 1909, in the 17th line from the bottom of column 2, the sentence reading: "The great plan in the argument of long life," etc., should read as follows: "The great flaw in the argument of long life."

The iron-ore properties in the State of Minnesota were assessed in 1908 at a total of $176,340,749, or about 20 per cent. of the total real-estate valuation. The taxes paid on the iron lands amounted to about 15½c. per ton of iron ore produced in 1907. On the smaller production of 1908 they were nearly 25c. per ton.

The Calcium Nitrate Industry in Norway

Sam Eyde, in a recent lecture, described the status of the "saltpeter" industry at Notodden, in Telemarken, Norway. He traced the undertaking from its conception, and, throughout the experimental stages, to its present maturity under the auspices of the Badische Anilin und Sodafabrik, whose rival method, together with capital requirements by the Norwegian promoters, necessitated an assimilation of interests. The Birkeland-Eyde nitrate industry at Notodden is epoch-making, in that it is the pioneer of its kind; from beginning to end it has been planned and carried out by Norwegians. Owing to breakdowns at the power station and factory, an average use of 13,000 kw. only was obtained in 1908, whereas the normal should have been 22,000 kw. In the last six months, allowing for occasional shortages of water, the average was 19,500 kw., with a revenue of about 1,500,000 kroner, and a cost of 970,000 kroner, which for the six months gives a net profit of 530,000 kroner. In experimental operations 1,000,000 kroner has been expended. The total capital in connection with the Notodden and Svölgfos construction was 11,000,000 kroner. The revenues will be further increased as soon as arrangements for the special production of ammonia nitrate and lime saltpeter, as well as the better regulation of the watersheds, are completed. Herr Eyde anticipates that with the further damming of the auxiliary falls, which would occupy 10 years, at a cost of 150,000,000 kroner, the yearly output of Norwegian nitrate would amount to 300,000 tons. Chile at present produces 1,800,000 tons annually—say, in 10 years' time (1920), 2,500,000 tons. As Norway's production in 1920 will have reached about 300,000 tons, to the value of 45,000,000 kroner yearly, it will only amount to about 12 per cent. of Chile's output in the same period. Chilean nitrate has to undergo a chemical process before it reaches the consumer, and climatic and labor drawbacks will in a high degree tend to prevent prices falling to a level that would threaten the Norwegian industry. Experiments with the practical use of Norway saltpeter have been carried out by authorities on agriculture in Norway, Sweden, Denmark, Germany, France, England and Scotland, Austria, Hungary and Italy, and results bear out the favorable opinion expressed by specialists on the first appearance of the fertilizer, viz., Norway saltpeter is equally as good as that from Chile; and in soil poor in lime it is even better.

The three companies connected with the Notodden-Rjukanfos power and nitrate production are: the Norwegian Power Company, capital 16,000,000 kroner; the Norwegian Saltpeter Works, capital 18,000,000 kroner; and the so-called Norwegian Transport Company, capital 3,000,000 kroner, which was formed to connect Rjukanfos, Notodden and Skien by rail and water.

Technical details of the Birkeland-Eyde process now in operation at Notodden, and that of the Badische furnace method are not generally available, nor will it be known which of the two processes will be adopted for the Rjukanfos construction until the Badische process has been installed and tried in a factory now being built at Notodden.

Tomboy Gold Mines, Ltd.

SPECIAL CORRESPONDENCE

This English company operates a gold mine at Telluride, Colo. The report for the year ended June 30, 1908, records a profit of £87,115 on the last 12 months' working. Owing to the development of large bodies of comparatively low-grade ore in the lower levels, a policy was adopted of reducing the grade so as to yield profits of £5000 per month instead of £8000 per month. This policy aims at lengthening the productive life of the mine and maintaining a uniform rate of production in the future. The ore reserves at the close of the company's financial year were estimated at 410,000 tons.

Work has been carried on mainly on the Argentine group of claims, the Tomboy group having been operated by leasers whose output netted the company in royalties the sum of $2153. The milling operations resulted in the crushing of 104,091 dry tons of ore from which bullion to the value of $657,561 and concentrates worth $341,459 were recovered. These amounts, together with $13,482 received for boarding house, rents, royalties, etc., gave a total revenue of $1,012,502. The expenditure on mining and development was $340,553, or $3.27 per ton; on milling, $134,742, or $1.29 per ton, and on general expenditure account, $58,910, or 57c. per ton. The total expenditure was $534,205, or $5.13 per ton, leaving a surplus of $478,296 on working account.

The manager, D. A. Herron, reports an interesting improvement in the treatment of middlings derived from the concentration of the ore in the mill. These middlings had formerly been a waste product. The new plant consists of classifiers, Wilfley tables, a roasting furnace and magnetic plant; and a separation of the iron, zinc and copper contents of the ore, with which some gold is associated, is effected. Zinc and iron concentrates of a marketable value are now produced. The plant was put into operation on Jan. 1 last. Experience has shown that the plant is capable of improvement and certain defects in the original design are to be remedied. The labor situation is reported to be now quite satisfactory.

The issued capital of the company is £300,000. For the year 1906-7 the dividend was 37½ per cent., and for 1907-8, 30 per cent. For the ensuing year it is proposed to hold in abeyance the development of the mine below the 2100-ft. level and to confine operations to the development of the orebodies indicated in a general way by the 1750- and 2100-ft. levels.

Mining in the Yukon Territory

SPECIAL CORRESPONDENCE

The report of the "Mining and Metallurgical Industries of Canada, 1907-8," states that the number of placer mines operated in the Yukon Territory on June 2, 1908, was approximately 7184. The Placer Mining act requires work to be done on each claim to the value of $200 each year, but claims may be grouped so that expenditure on one or more claims shall be considered as covering all claims included in the group, and all the claims enumerated have been worked either separately or as one of a group. The number of quartz-mining claims in good standing in the Territory is approximately 1054. In the southern section extensive operations in copper and gold mining are being carried on. At Whitehorse a number of copper mines are in operation, and considerable quantities of ore being shipped. At Conrad considerable development in gold-quartz mining has been done with good results. There are 13 hydraulic mining locations in existence, comprising a total frontage of 38½ miles, which are all being operated in some degree. There are 58 dredging leases, comprising 304 miles of the submerged beds of rivers. These leases are confined to the Yukon, Forty Mile, Klondike, Stewart and Hootalinqua rivers. There were 12 large dredges in operation, nearly all having an indicated capacity of about 3000 cu.yd. per day, and it was anticipated that before the end of the season several others would be installed.

The only means by which the department can compute the production of gold in the Yukon is upon the amount on which royalty has been paid. The provision for the payment of a royalty came into force Sept. 11, 1897, and the records since that date show a total production of $82,983,636. The maximum production was reached in 1902-3 with an output of $12,113,015, each subsequent year showing a falling off, as will be seen by the following figures: 1903-4, $10,790,663; 1904-5, $8,222,053; 1905-6, $6,540,007; 1906-7, $3,304,791; 1907-8, $2,820,161.

Two coal mines were in operation. The Tantalus, about 215 miles above Dawson produced last year over 7000 tons and the Sourdough, about 50 miles below Dawson, produced over 5000 tons. The coals retails at from $15 to $18 per ton.

Personals

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

A mail car containing a number of copies of THE ENGINEERING AND MINING JOURNAL of Feb. 27 was destroyed by fire in Illinois. Subscribers who have failed to receive that issue may obtain it by sending a postal card to this office. Our number of extra copies being small, subscribers will confer upon us a favor by making applications promptly.

Paul R. Forbes has returned to Mexico.

Allen H. Rogers has returned from Chile.

E. P. Mathewson, of Anaconda, Mont., has been visiting New York.

Richard A. Parker, Denver, Colo., visited New York and Boston last week.

S. H. Brockunier has returned to Wheeling, W. Va., from Alaska.

L. C. Church, of Joplin, Mo., has examined zinc-lead deposits at Alva, Oklahoma.

J. R. Finlay leaves New York this week for a trip to the Pacific coast, where he expects to be for about a month.

Henry C. Beeler, recently State geologist of Wyoming, has opened an office at Denver, Colo., as mining engineer.

F. C. Roberts has resigned his position as manager of the Ventanas mine in Durango, Mexico, and will return to San Francisco.

William C. Seddon, of Baltimore, has been chosen chairman of the executive committee of the Alabama Consolidated Coal and Iron Company.

W. E. Miller, of Glasgow, Scotland, secretary of the Arizona Copper Company, Ltd., is inspecting the company's mines and works at Clifton and Morenci, Arizona.

Douglas Muir has resigned his position as superintendent of the mill and cyanide plant of El Conde Mining Company at Tepehuanes, Durango, Mexico, to take effect May 1 next.

Thomas Cox, formerly at Ely, Nev., and for some time past at Cerro de Pasco, Peru, expects to return to this country about June, and will open an office in San Francisco.

James L. Bruce, late engineer and assistant superintendent of the Grace Zinc Company, has been appointed general superintendent of the Continental Zinc Company at Joplin, Missouri.

F. A. Jordan has resigned his position as general superintendent of the Continental Zinc Company at Joplin, Mo., to take charge of an iron mine in the Moose Mountain district in western Ontario.

Robert Hawxhurst, Jr., remains in Chile as general manager of the Poderosa Mining Company, Ltd., of London, which has recently acquired the properties of the Compañia Minera Poderosa de Collahuasi, Chile.

J. R. Dallas has resigned his position as engineer for the Leetonia Mining Company at Hibbing, Minn., to accept a position as manager for the Wheeling Gold Range Mining Company, at Sodaville, Esmeralda county, Nevada.

James Taylor has been appointed mine inspector for the sixth Illinois district, with office at Springfield. He succeeds Thomas Hannah, resigned. Mr. Taylor was formerly in Illinois, but for some years past has been managing a mine in Alberta, Canada.

C. A. Pringle, recently in Mexico, has been appointed manager of the Tintic Mining and Development Company's properties in the Bingham district, Utah. These include the Yampa smelter. He succeeds C. W. Saxman, resigned. J. C. Dick, general superintendent has also resigned.

George T. Oliver, just chosen United States Senator from Pennsylvania, was, until recently, engaged in the steel business. He was first vice-president and afterward president of the Oliver Wire Company until that company disposed of its plants in 1899. In 1889 he became president of the Hainsworth Steel Company and retained that position until its merger with the Oliver & Snyder Steel Company in 1897, of which he was president, until he disposed of his interest in the concern a few years ago.

Obituary

John Stevenson, superintendent of the Dunlap-Connellsville Coke Company, died at Hecla, Penn., March 6, aged 55 years. He had been employed in the Connellsville region for many years.

William McCully McKelvy died at Pittsburg, Feb. 28, aged 70 years. He was born in Pittsburg. He was president of the Alpha Portland Cement Company, a director of the Lockhart Iron and Steel Company, and of the Pittsburg Foundry Company.

James Robertson, Coatesville, Penn., died March 4, aged 48 years. He was superintendent of the open-hearth steel department of the Lukens Iron and Steel Company. He was a native of Glasgow, Scotland, came to this country about 24 years ago, and since then has been prominent in open-hearth steel practice, being connected with the above-named company since 1901.

John E. Carr, who died at Leavenworth, Kan., March 4, aged 69 years, was born in England and brought up as a mining engineer. He came to this country nearly 42 years ago. In 1872 he took charge of a coal mine near Leavenworth, and was actively engaged in opening and managing coal mines in Kansas until his retirement a few years ago. He was the first man to put coal mining in Kansas on a paying basis.

George Everest, a miner, died recently at the age of 80 years, near Igo, in Shasta county, Cal., where he first went at the end of 1848. He had never since that time been outside of what is now Shasta county, and had continued mining operations all that period, never having followed any other occupation. While a record to the contrary would have been satisfactory, it is necessary to note that he died a poor man.

Societies and Technical Schools

Montana Society of Engineers—At the monthly meeting in Butte, Feb. 13, Victor C. Heikes, of the United States Geological Survey, with headquarters at Salt Lake, Utah, gave an interesting talk about the statistical labors of the Survey under his charge, within the district comprising Arizona, Idaho, Montana and Utah.

Canadian Cement and Concrete Association—The first annual convention and exhibition of this association was held in Toronto March 1-6. About 60 manufacturers were represented at the exhibition, which was opened by Hon. Doctor Reaume, Ontario minister of public works, who said that the provincial government had taken a leading part in introducing the use of concrete for bridges, dams, etc., and recommending it to municipal bodies. The convention proper met on March 2 and was largely attended. The opening address of President Peter Gillespie, Toronto, presented a comprehensive review of the growth of the portland-cement industry in America. He urged the adoption of a standard form of specification for city contracts, and recommended the establishment of a government laboratory for the testing of materials. Dean Galbraith, of the faculty of engineering, Toronto University, said that with cement it was now possible to economize the wood used in building and conserve the forests. A large number of papers were read and addresses given. Among those who addressed the convention were A. W. Campbell, deputy minister of public works, Toronto; Emile G. Perrolt, Philadelphia; Prof. E. Brown, McGill University, Montreal; J. E. Moore, Chicago; J. Augustine Smith, South Bend, Ind., and Charles D. Watson, Cleveland. Officers were elected as follows: President, Prof. Peter Gillespie, Toronto; vice-president, Gustave Kahn, Toronto; councillors, T. L. Dakes, Owen Sound, Ont.; Kennedy Stinson, Montreal; C. A. Lingham, C. Caniff, J. G. Murphy, D. Raymond and C. H. Thompson, Toronto.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Butte, Salt Lake City, Denver, Toronto and Indianapolis

REVIEWS OF IMPORTANT EVENTS

San Francisco

March 12—While the State of California is producing nearly 50,000,000 bbl. of petroleum annually, it seems rather odd that some oil should also be imported. During the fall months of last year 4,694,000 gal. of light oils, or tops, came into this port under the name of naphtha, from Singapore. It originated on the island of Sumatra. An export duty of 6 per cent. was imposed, and this country, to counteract that, imposes a 6-per cent. import duty. The light oil is used in the refineries on San Francisco bay in making illuminating oils, being added in suitable proportions during the process of manufacture of lighting oil from California petroleum. The California oils are mostly heavy ones, with asphalt base, and light oils are rather scarce.

The State Anti-Débris Association has received a surprise in having Yuba county cut off further money contributions. This association has been maintained by the counties of Yuba, Sutter and Sacramento, the supervisors of which contribute a monthly allowance. Yuba has been paying $225 per month but at the last meeting of the board of supervisors it was decided to discontinue these payments for the future.

The mayor of Sacramento has announced that he will shortly call a convention to see what steps may be necessary to control or to stop dredge mining. Some of the newspapers are now calling on the engineers of the California Débris Commission to come forward with the necessary information about this industry. As it happens, however, this commission has nothing whatever to do with dredge mining, and has not studied its details. How the people at the proposed mass meeting are to get at facts when men interested in the subject, and having knowledge of it, are not invited to attend, remains to be seen. The dredge men have little fear of this since they can have exact facts brought out in court should litigation ensue.

The bill drawn by Senator Caminetti to appoint an advisory board of the department of engineering which might permit the building of impounding dams at hydraulic mines without going to the present expense of applying to the California Débris Commission, has been so amended that no final action can be taken without reporting to the legislature. It is also provided in the amendments that the courts have power to review the proceedings. With these amendments the bill has passed the Senate and gone to the Assembly. The proposed law was intended to simplify matters for small hydraulic mines.

Salt Lake City

March 12—The United States Supreme Court has, for want of jurisdiction, dismissed the suit of the Mammoth Mining Company *vs.* The Grand Central Mining Company, which is generally construed as a victory for the latter company. The case which involved the question of apex, has been fought over nine years. A judgment of approximately $170,000 stands against the Mammoth company.

For the week ending March 5, 184 cars of ore were shipped from the Tintic district. The following mines shipped in 20-ton cars: Colorado, 39 cars; Black Jack, 1; Beck Tunnel, 9; Brooklyn, 8; Dragon Iron, 34; Iron Blossom, 3; Swansea Consolidated, 1. The following mines shipped in 50-ton cars: Ajax, 9 cars; Horn Silver, 3; Silver Shield, 4; Bullion Beck, 2; Centennial Eureka, 46; Eureka Hill, 3; Mammoth, 1; May Day, 4; May Day concentrates, 1; Ridge & Valley, 2; Sioux Consolidated, 14.

Butte

March 10—Plans formulated some time ago for raising $85,000 for the purpose of meeting option payments and paying off indebtedness of the Pilot-Butte Copper Company are meeting with an indifferent response from the stockholders. W. P. Jahn, president of the company, has recently issued another letter requesting response to the former appeal for subscriptions and calling attention to the loss which will be incurred in the event of failure to take up the option on the Pilot claim. He states that unless a payment of $35,000 is made on the option from N. J. Beilenberg the company will lose the quarter interst represented by the option, on which several substantial payments have already been made.

In the action of Alonzo W. Evans against the Lake Shore Gold Mining Company, in which plaintiff secured a default judgment for $10,123 some time ago, a satisfaction of judgment was filed by Evans a few days ago. Evans also filed a motion to set aside the judgment against the company, stating that his attorney had entered the judgment without his knowledge at a time when he, the plaintiff, was negotiating a compromise. Evans' attorney is now resisting the cancellation of the judgment on the ground that he has a lien upon the same for the payment of his fee amounting to $2263.

The Western Mining and Supply Company, of Butte, has brought suit against the North Butte Extension Copper Mining Company and the North Butte Extension Development Company for a sum slightly under $1000 alleged to be due as rental for a pump used by the latter companies. An attachment has been levied upon the Black Crow, Overman, Occidental, Free Trade, Third Sphinx and Michigander quartz lode claims and the Clipper and Assay mill sites.

Denver

March 13—It does not seem likely that our State legislature will pass any laws this session looking toward the regulation of the smelters, and fortunately so, for it would appear better for these matters to be regulated by competition than by legislative compulsion.

A despatch from Salt Lake City today states that the Utah Mine Operators' Association has called for a conference to be held in that city March 25 by representatives from the principal lead camps of Utah, Nevada, Idaho and Colorado, the object being to devise means of protecting the lead-mining industry from the action of those who seek to reduce the tariff during the present session of Congress.

Goldfield, Nevada

March 9—The ore treated and shipped from Goldfield for the week ending March 6 was as follows: Nevada Goldfield Reduction Company, 685 tons averaging $40 per ton; 50 tons from Pioneer at $90 per ton; Consolidated and Combination mills, 4500 tons, estimated value $40 per ton; Goldfield-Florence, 800 tons averaging $20 per ton, and 225 tons shipped through Western Ore Purchasing Company the value of which is not made public.

Tonopah shipments: Tonopah Mining, 3150 tons; Belmont, 920 tons; Montana-Tonopah, 760 tons; Jim Butler, 300 tons; MacNamara, 235 tons; West End, 100 tons, and Midway, 100 tons. Total estimated value of $135,000.

C. A. Gehrman, superintendent of the Florence-Goldfield, last week tendered his resignation, which was accepted. George Wingfield was elected president of the Goldfield Mining Stock Exchange March 3, to succeed H. T. Bragdon, who resigned on account of ill health. Mr. Wingfield's election was made at a meeting of the

board of directors after receiving a communication from him at Washington, stating that he would accept the position.

Senator Payne's bill providing for an exhibit and appropriation for the session of the Mining Congress to be held at Goldfield this fall, passed the Senate March 3, and has gone to the House. The law creates a commission of three who shall collect mineral exhibits from the various parts of the State and carries an appropriation of $5000.

Indianapolis

March 15—The 20th annual convention of United Mine Workers of Indiana held a five-days' session at Terre Haute last week. Government ownership of coal mines as a solution of the problem of caring for disabled and worn-out miners was a proposition advanced by a number of delegates.

W. J. Woods, president of the Indiana Railroad Commission, addressed the convention, pointing out what the commission is doing to protect the lives of men employed about the railroad switches leading to the mines and elsewhere.

The convention emphasized the sentiment of breaking away from the old political parties and having labor demand that its own members represent it in public office. The miners are greatly disappointed over the rejection by the last legislature of bills introduced by labor interest.

W. H. Blatchley, State geologist, is in a quandary over the appointment of a State mine inspector. Under the new law 13 applicants took the first examination for appointment as State mine inspector and deputies and not one made the required grade of 85 per cent. Three of the number made grades of 80 per cent. The written examination covered questions relating to chemistry as applied to coal mining, mine engineering, and practical coal mining.

Among the applicants who failed to make the required grade were the present State mine inspector and his deputies, but Mr. Blatchley says the item of experience has not been sufficiently considered, and he believes when this is done a number of the applicants will have grades sufficient to comply with the law. Mr. Blatchley has submitted the matter to the attorney-general for an opinion.

Toronto

March 12—A return presented to the House of Commons at Ottawa, shows the approximate area of coal-mining lands in Saskatchewan to be 10,648 acres and in Alberta 373,691 acres. From payments for coal lands since Jan. 1, 1906, the government had received in Saskatchewan $22,786; in Alberta $1,116,413, and from coal royalties $22,300 in Saskatchewan and $23,514 in Alberta.

The situation in the Gowganda mining district during the early spring is likely to be serious, as between the breaking up of the winter roads and the opening of navigation some weeks must elapse, during which the new camp will be practically isolated. It is estimated that there are now upward of 10,000 people in the district, who unless extraordinary measures are taken to provide for them, may suffer for want of food. Every endeavor is being made to keep the line of communication open as long as possible and an immense quantity of freight is going into the country. The expense of freight is enormous, a rate of $50 per ton being charged from Charlton to Gowganda. Teams are hired at $15 per day.

The Canadian Pacific Railway has officially announced that, as soon as the frost breaks, a canoe freight route will be opened to Gowganda from a point on the line 35 miles west of Sudbury. As there are long stretches of lake navigation along this route, on which launches can be used, they will have, in addition to canoes, a number of launches for the heavier freight, putting horses on the portages to secure quick transhipment. The route is by way of Duncan lake, Shining Tree lake, Wapoose river and Montreal river.

Johannesburg

Feb. 25—Asbestos, of the chrysotile variety, occurs in many parts of South Africa, and the deposits of importance being opened up at present are situated in the Carolina district of eastern Transvaal, and the Victoria district, Rhodesia. The asbestos exported from Cape Colony is a fibrous amphibole. The Carolina company, controlled by one of the Rand's big houses, has issued a report showing that 281 tons of asbestos, mostly hand-cobbed, were produced during the last fiscal year. The profit of £20 may appear insignificant enough, but it compares favorably with the margin between revenue and expenditure declared by the majority of pioneer concerns floated in the outside districts during recent years. The crude produced is of good quality and 60 per cent. of it shows fibers over 1 in. long. Mining costs are naturally high, as the vein of productive serpentine averages only 2 ft. in thickness.

Yet another development record has been established. At the Van Dyk, in the East Rand, 323 ft. were driven in 62 shifts, with two 3½-in. Ingersoll-Sergeant machines. The ground, though deep, must have been especially favorable. Only 12 holes per round were required and each round, accounting for 5.21 ft. of average progress, required 44.3 lb. of blasting gelatine. It may be mentioned that the Brakpan company, which has done exceptionally speedy work in vertical and incline shaft sinking, is in the vicinity, and it would appear that the East Rand basin will, as a whole, be found cheaper to develop than other parts of the field.

The year 1908 has been anything but a prosperous one in the South African diamond mines, yet the fascinations of the work hold a large community of adventurers to the alluvial of the Orange River Colony, Griqualand West and the Transvaal. The relieving feature of the year's record has been provided by the new Harrismith diggings in the Orange River Colony. Mayer's Prospect has been proved rich and from a block 600 by 240 ft. in extent stones to the value of £30,000 are reported to have been won.

Paris, France

March 6—The study of the Lorraine coalfield has brought new facts to light. Borings undertaken at Gironcourt, near Mirecourt, have shown coal seams at a depth of 700 and 823 m. The first is 70 cm. thick, the second 60. Trias and Permian were only 270 m. thick at that spot, instead of 1020 m., as found by previous boring at Mont sur Meurthe. The belief is that it is the upper coal formation that has been struck. The coal producers in the north of France are striving to keep up the price of coal. The companies are divided into two groups; those that have joined the Douai Consortium and those that have not. The Consortium has lost ground in the East where German and Belgian coals are sold, but has succeeded so far in keeping up higher prices than the outsiders.

Official statistics of coal production for the departments of Nord and Pas-de-Calais show that the year 1908 holds the record, the coal mined being over 25,000,000 tons, against 24,000,000 in 1907. This result is remarkable since 1908 has been a poor year for the metallurgical industry. The output of both coalfields 10 years ago—in 1899—was 20,000,000 tons only. The advent of Belgian workmen is one of the chief factors in this increase. They bring in a reinforcement eagerly welcomed in France where the question of labor is often a hard one.

The Société des Gisements d'Or de St. Elie (French Guiana) made a profit of only 175,737 fr. in 1907-08. The company works its alluvial deposits of St. Elie and Dieu Merci on the leasing system, mines paying a royalty. In all, 244 kg. of gold have been saved, by the lessees. The Société des Mines de Zinc d'Ain Arko (Algeria) has just made its first report. On a capital of 1,500,000 fr. the profits amounted to 1,283,197 ft. This company proposes to pay 50 per cent. per share of 100 fr., having already repaid 25 fr. per share last year, and hopes to repay the balance of its capital at the close of the new year. It also expects to bring the output up from 12,000 to 15,000 tons. The concentrating mill built for dealing with calamine ores, which were not previously treated was put into commission in December last.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Alabama

BIBB COUNTY

At Centerville, recently, two of the men charged with firing into a train carrying non-union miners and guards at Blockton, during the strike last August, were tried and convicted. Mileto Papovitch was convicted of murder in the second degree and sentenced to three years at hard labor. Boris Dabovitch was convicted of murder in the first degree and sentenced to imprisonment for life. Both were defended by counsel employed by the United Mine Workers.

JEFFERSON COUNTY

The Alabama Consolidated Coal and Iron Company has filed a second mortgage on its properties to the amount of $5,000,000. Part of the money will be used in redeeming some of the outstanding bonds and part in improvements. The company is said to have sold a large quantity of iron recently.

The annual meeting of the Sloss-Sheffield Steel and Iron Company was held in Jersey City during the past week. Despite the fact that there was a great depression on last year, a surplus was reported. The same officers and board of directors were reëlected.

Alaska

Haines Mining and Milling Company—A Nissen stamp mill has been purchased for the mine back of Valdez. The officers report the possession of several ledges, the average value of which is about $30 per ton.

Mother Lode—George E. Baldwin has been appointed superintendent. He was formerly with the Guggenheim interests in charge of the Bonanza mines.

Arizona

GILA COUNTY

Inspiration Mining Company—Stockholders voted to amend the articles of incorporation, changing the name of the company to the Majestic Copper Company.

Cordova Copper—Henry B. Hovland, Hoval A. Smith and associates have arranged for the merger of the Eureka group of claims and the properties now owned and under bond by the Globe Consolidated Copper Company. The new company will have a capitalization of 300,000 shares, par value $10. One hundred thousand shares full paid Cordova copper stock will be issued for the 100,000 shares outstanding full paid Globe Consolidated Copper Company stock. There will be issued 125,000 shares, $2 first call and $8 per share remaining due, subject to the call of the board of directors. Part of this stock will be exchanged for outstanding Globe Consolidated stock, and 70,000 shares unissued and under option will remain in the treasury. M. E. McCarthy will have charge of the property.

GRAHAM COUNTY

Graham County—March 5, 1909, the legislature of Arizona passed a bill which provides that Graham county shall be divided into two counties and that the new county, Greenlee, which contains most of the mines of the district, shall bear all of the bonded indebtedness of the present Graham county, amounting to about $146,000. The new county is named for Mace Greenlee, the first prospector to explore the district. The southern half of the county will still be known as Graham county. The division takes effect Aug. 30, 1910.

Arizona Copper—Plans are being made to install an electric fire-alarm system at Clifton and Morenci. The production of copper for the month of February was 1273 tons.

Standard—A contract was recently closed with the Detroit Copper Mining Company whereby shipments of ore may be sent from Metcalf to Clifton *via* the Longfellow incline. The Arizona Copper Company will haul the ore from the incline to the smelter.

MARICOPA COUNTY

Vulture—Ten stamps of the old 80-stamp mill have been repaired and are now working on ore that is taken out in development work. Forty-five men are employed.

Arkansas

JOHNSON COUNTY

Little Rock Packet Company—This company, recently incorporated with a capital stock of $200,000 by W. M. Kavanaugh and associates, has closed a contract with W. H. West, of Coal Hill, Ark., for the lease of 1000 acres of coal land in the Coal Hill district. The lease is for 10 years, and contains an option by which the company may purchase the property. There is at present a mine in operation, producing from 400 to 500 tons of coal per day, and it is the intention of the lessee to continue developments.

California

AMADOR COUNTY

Argonaut—A complete change of management has been effected. J. W. Lilienthal is now president; B. F. Taylor, vice-president; E. V. Zumbiel, secretary; R. S. Rainford, superintendent. Rapid development is now expected to take place.

Central Eureka—The work being done in reopening the shaft is within 400 ft. of the bottom and it is intended to sink much deeper.

Kennedy—At this extensive property, Jackson, a fine orebody has been found on the 3150-ft. level. Some of the rock being taken out is exceptionally rich, and the average values are as good as those when the mine was first discovered.

CALAVERAS COUNTY

Easzy Bird and Peek Ranch—The people who have been bargaining for these mines have made first payment, and the deal has been closed.

Maine—At this old mine, West Point, a new shaft is being sunk by B. D. Porteous and D. O. Oliver.

INYO COUNTY

Estelle—This company is driving a tunnel near Keeler to cut a vein of silver-lead-copper ore. It will be 8000 ft. long and some 500 ft. have been driven. Machine drills are advancing the work at the rate of 10 ft. per day.

Lane—Reynolds & Peterson, of Darwin, are hoisting ore from the old workings of this mine.

Lost Burro—The first payment has been made. The operators will ship the high-grade ore while the mill is being built. Work will commence at once. The mine is in the Ubehebe district.

MARIPOSA COUNTY

Enterprise—At this property, near Hornitos, 12 men are at work taking out good ore, and the mill is kept at work steadily. New machinery is soon to be installed. F. H. McCall is manager.

SIERRA COUNTY

Snowden Hill—The new bedrock tunnel is being driven rapidly ahead and an upraise for the gravel will soon be made. The mine is owned by the American Mining and Development Company, and was one time known as the Jerry Watts placer. The property is seven miles from Camptonville.

Colorado

LAKE COUNTY—LEADVILLE

Vinnie—Another pocket of rich ore was recently taken from this property on Breece hill. The mine is worked from the Yak tunnel and the company has this month declared a dividend of 1 per cent., equivalent to $5000.

Butte—During the week a two-foot gold-bearing vein was encountered in the tunnel.

Buckeye—This section lies to the northeast of Leadville and the little work that has been done on the surface shows that the formation is the same as that of Breece hill. Indications are promising.

Dinero—The present drawback to the successful working of the orebody opened last September in the tunnel is the water that accumulated in the old workings when the property was idle. This is being obviated by the driving of three upraises. At present the company is shipping about four cars of ore per week and the smelter returns show 50 oz. silver per ton.

Bartlett Tunnel—Preparations are now under way to drive this tunnel in Sugar Loaf district several hundred feet farther into the hill. A body of ore running high in silver has been opened in one of the drifts. The new company that took hold of the property recently is known as the George Nash Mining Company.

Cleveland—The shaft is now 785 ft. deep, leaving 40 ft. still to be sunk to complete the contract of 200 feet.

SAN JUAN COUNTY

Silver Lake—The electrical machinery at the mill has been completely overhauled and the mill will be started as soon as the crushing rolls are erected. There is a large quantity of ore in the bins.

Indiana

SULLIVAN COUNTY

A decree of foreclosure in favor of the First Trust and Savings Bank of Chicago has been entered against the Southern Indiana and Indiana Southern Coal companies. The mortgage indebtedness against the Indiana Southern Coal Company is $1,500,000, and that against the Southern Indiana Coal Company is $1,842,000. All of the properties of the two companies, including mines and lands in this and adjoining counties, are subject to the sale.

WARRICK COUNTY

A 6-ft. vein of coal has been discovered two miles southwest of Booneville. The vein is about 50 ft. below the surface and roof conditions good. The farm of 225 acres underlaid with this coal belongs to Henry Korf, of Evansville. This is one of the richest finds made in this part of the State for some time. The length of the vein is unknown, but it is believed to extend over considerable territory.

Michigan

COPPER

Quincy—The Pontiac or No. 9 shaft is down below the 300-ft. level and shows good copper-bearing rock. The land tributary to this shaft is being prospected by drifts from No. 8 shaft which are now within 800 ft. of the new shaft. The framework for a shaft house is on the ground.

Franklin—Sinking continues at No. 3 shaft on the Pewabic lode below the 700-ft. level. This lode is well mineralized at the drifts from the 22d and 23d levels of No. 1 shaft. All work on the Conglomerate lode is being centered in mining the previously blocked-out ore. It will take about a year to clean this all up.

Lake—Sinking continues at a depth of over 500 ft., and drifting is under way on the 410-ft. level. It is necessary to extend the workings to ascertain the value of the property.

Ojibway—The west bed of the Kearsarge lode opened at the 650-ft. level of No. 1 shaft is showing up well. At No. 2 shaft the crosscut from this same depth is nearing the lode and should encounter it about the same time that the shaft reaches the 800-ft. level.

Calumet & Hecla—The second portion of the regrinding mill will soon be ready to go into regular commission. Results that have been obtained from the first quarter of this mill are satisfactory.

Island Copper—This company has been recently organized under the laws of Michigan and will carry on operations in Houghton and Keweenaw counties, but principally on Isle Royal island. The company is capitalized at $1,000,000 with 40,000 shares of $25 par value, with offices at Houghton and Duluth.

Centennial—The annual meeting of stockholders will be held at Boston, Mass., April 6, 1909.

Missouri

ZINC-LEAD DISTRICT

Monticello—This company has incorporated with a capital stock of $100,000 to operate the Monticello mine at Prosperity. F. A. Brown, R. K. Pitkin, the manager, and Byron Bourne, all of Joplin, are the stockholders.

Myrick—This mill, southwest of Joplin has been destroyed by fire.

Montana

BUTTE DISTRICT

Coalition—A station is being cut on the so-called 1700 level of the Tramway mine, which is in reality, about 1820 ft. below the surface. Production through this shaft averages between 600 and 650 tons daily, chiefly of ore mined from the Minnie Healy ground. The 1300-, 1400-, 1500- and 1600-ft. levels are being worked, the greater production coming from the 1400- and 1500-ft. levels. An electric tramway carries the ore from the shaft to the ore bins, a distance of about 200 ft. The Rarus mine is producing about 850 tons daily.

DEER LODGE COUNTY

Southern Cross—Shipments of ore have recently been resumed. Twenty men are employed. With the advent of more favorable weather the stamp mill on the property will be put in operation.

Oro Fino—Anderson & Boscum have a lease on this claim, situated near Georgetown, and have shipped five cars of ore since the first of the year. The gold-bearing ledge is being worked through a tunnel.

FERGUS COUNTY

Barnes-King—About 120 men are employed. During the past 12 months the mine has been operating with a net profit of from $1000 to $5000 per month. The management states that during February the bullion produced amounted to $25,000 and the operating expenses to about $15,000.

The annual meeting of the stockholders was held at Kendall, Mont., March 3. The following directors were elected: John Gillie, C. W. Goodale, Donald Campbell, L. O. Evans and Phil. C. Goodwin, all of Butte; W. H. A. Fischer, New York City; John L. Bright and Wilfred Johnson, of Lewiston, Mont.

GRANITE COUNTY

Senate Group—An order of court has recently been made approving the sale of the property, situated in the Moose Lake district, to George M. Bourquin, of Butte. The sale was made by the executor of the estate of Ernest Cranmer.

JEFFERSON COUNTY

Corbin Copper Company—The management states that in the three tunnels on the Anna, Rosalie and Dewey claims, an average of 12 ft. advance is being made daily. About 50 men are employed.

Boston & Corbin—The shaft has reached the 700-ft. mark and is being enlarged from two to three compartments. A crosscut from this level will tap the vein 200 ft. below the present workings.

Raymond Mining Company—The property is situated three miles east of Clancy and carries gold and silver. The management states that they plan to resume operations early in the spring.

LEWIS AND CLARK COUNTY

Souvenir Gold—At a meeting of stockholders held last week the proposition of J. H. Simpson for a reorganization of the company was accepted. The present

company is capitalized at $300,000 with 1,200,000 shares of the par value of 25c. each. The proposed company will have the same capitalization, but with 300,000 shares of the par value of $1.

Nevada

CHURCHILL COUNTY—JESSUP

Rochelle Mine—A strike is reported on this property, owned by Messrs. Rice and Bailey. The vein, which is two feet wide, shows free gold. A shaft has been started and a hoist will be installed.

Eureka Mine—Messrs. Ratcliffe, Mack and Loose, owners of this group have a shaft down 130 ft. from which a drift has encountered ore. The ore is being sacked for shipment and a power hoist is to be installed.

ESMERALDA COUNTY—GOLDFIELD

Goldfield Consolidated—A strike of large proportion is reported on the 600-ft. level of the Mohawk. The vein is said to have a width of 40 feet.

Combination Fraction—The output was slightly over $40,000 for the month of February. The mine is in good shape with a number of available stopes.

ESMERALDA COUNTY—ATLANTA

Fairview-Cherokee Lease—An 18-ft. ledge of quartz has been opened on the 500-ft. level. The ore is not of a shipping grade, but it is improving as drifting goes on.

ESMERALDA COUNTY—HORNSILVER

Orleans Mine—Small shipments continue regularly. The new, vertical, working shaft recently started, disclosed an ore shoot 10 ft. wide at the 65-ft. level, from which ore is now being taken. A gasolene hoist will be installed at once.

Hornsilver Mining Company—H. B. Taylor, of the Goldfield Engineers' Lease and Geo. B. Holleran will resume operations. The old hoist will be moved to the shaft on the Cable Lease, which will be sunk to the 300-ft. level before any laterals are run.

ESMERALDA COUNTY—RAWHIDE

Coalition Estate—There are now 40 leases in operation on this property. Ten are making regular shipments. Nineteen hoists are in operation and large bodies of milling and shipping ore are being developed.

LANDER COUNTY—HILL TOP

Hill Top Mine—This property is about 20 miles southeast of Battle mountain. The first shipment consisted of two tons of selected ore that netted over $2 a pound after deducting all expenses. The district is not yet three months old and already has several properties shipping. A controlling interest in the Hill Top was recently sold to P. J. Queely, a coal operator of Rock Springs, Wyo., for $110,000.

LINCOLN COUNTY

Pioneer Oil—Operations are at Indian Springs, about 20 miles from Las Vegas, Nevada. A drilling outfit costing $6000 has been purchased and will be placed in service at once.

Nevada Oil—This is a new corporation, with a capital stock of $100,000. The company owns 24,000 acres of oil land near Indian Springs. The officers are: Frank Oliver, president; F. A. Lucy, vice-president and treasurer; A. J. Sommers, secretary; Ira McFarland, general manager. Headquarters will be maintained at Goldfield.

NYE COUNTY—TONOPAH

Montana-Tonopah—The new refinery was completed last week and the first run was made March 3. The product representing a 15 day's cleanup was 21 bars of bullion weighing 90 lb. each. During the week 790 tons of rock were crushed, 235 tons of which came from the MacNamara. An unusually large amount of development work was performed during the week.

Jim Butler—S. H. Brady, formerly of the Belmont, was appointed superintendent of the property and took charge March 1, filling the vacancy made by the resignation of Alex Johnson. It is reported that extensive development work will be carried on from both the Stone Cabin and Wandering Boy shafts.

STOREY COUNTY—VIRGINIA CITY

Sutro Tunnel—The fire of two months ago resulted in great damage to the tunnel. A heavy cave has taken place destroying the stave pipe which was at that time being installed, thus seriously retarding the flow of water. The flume underneath the track, instead of being cleaned out by the greater pressure of water has become clogged and 50 men are now working six-hour shifts in the endeavor to remedy matters. At the time of the fire, the water was held below the 2450-ft. level, but now the 2400-ft. level is flooded and the water is still rising. An effort is being made to prevent its rise to the 2350-ft. level where there are a number of expensive pumps, hoists and other machinery.

New Mexico

GRANT COUNTY

Monte Cristo—Returns from the first shipment of ore from the Pearl mine at Sylvanite yield $320 per ton. The Monte Cristo is a new company, the officers of which are: H. J. Bowles, president; H. W. Baylor, vice-president; D. W. Barnhill, secretary and treasurer; all of Uvalde, Texas.

Mogollon Gold and Copper—A reorganization has been effected. The new officers are Frederick M. Seward, Goshen, N. Y., president; W. B. Royce, Middletown, N. Y., vice-president; Frank P. Jones, Silver City, secretary and treasurer.

Grant County Telephone—This company has just completed its line to the Mogollon, connecting with all points of importance between that district and Silver City.

Oklahoma

PITTSBURG COUNTY

On Feb. 23 there was an explosion in mine No. 8 of the Rock Island Coal Company by which nine men were hurt. Later H. C. Booth, general manager; Robert Pickett, superintendent, and James Curran, pit-boss, were arrested and held for trial on complaint of Peter Hanraty, district mine inspector. He charged that the men were allowed to go to work there and to fire their own shots which, he says, was a clear violation of the law.

Oregon

JOSEPHINE COUNTY

Oriole Gold Mining Company—This company, capitalized at $1,000,000, has just been organized; the home office is at Salem. The president is B. F. Rowland; vice-president and general manager, J. C. Mattison; secretary, O. S. Blanchard; treasurer, G. W. Donnell.

LANE COUNTY

West Coast—A gold brick worth $5000 was shipped to San Francisco as part of the February clean up. Ten men are now steadily employed in the mines; the future looks bright and prosperous. More men will soon be put to work blocking out ore in the tunnels.

The present company is the reorganization effected when the Oregon Securities Company failed. Mr. Ryan is superintendent.

St. Peters Creek—A. P. Churchill, owner, near Bohemia, has discovered an ore vein that pans well in gold. The property is only a prospect. The ledge is about 4 ft. wide. Its extent has not yet been ascertained.

Martin Creek—S. H. Burghardt, manager, reports some fine ore in the tunnels. Work has been in progress all winter, and it is reported that a plant will be installed in the early summer.

Combination—Good progress is being made with the development work, and as soon as the roads are better so as to make freighting possible they will build a concentrator. Some very rich silver ore has been found lately.

Golden Rule—Good work is being done on this property near Bohemia, and the company is now applying for a patent to its mining claims. It has made ar-

rangements for the capital needed to install a complete mining plant, concentrator and sawmill.

Pennsylvania

ANTHRACITE COAL

Philadelphia & Reading Coal and Iron Company—The statement for January and the seven months of the fiscal year from July 1 to Jan. 31 is as follows:

	January.	Seven Mos.
Earnings	$3,072,526	$20,305,654
Expenses	2,959,817	19,130,351
Net earnings	$ 112,709	$ 1,175,303

For the seven months there were decreases of $3,838,845 in earnings; of $3,011,298 in expenses; and of $827,547 in net earnings.

BITUMINOUS COAL

J. V. Thompson, representing Pittsburg parties, has bought a tract of 5485 acres of coal land near Waynesburg, in Greene county. It is said that the land is to be developed soon.

South Dakota

CUSTER COUNTY

The mica mine of the Westinghouse Electric Company at Custer has temporarily suspended operations.

LAWRENCE COUNTY

Gold Eagle—A two-compartment shaft is being sunk on its main orebody. The shaft starts from the end of a 360-ft. tunnel and the contract is let for 500 ft. Crosscutting will begin at the 100-ft. level.

Golden Girl—Development work is shortly to be started. A number of prospect shafts will be sunk upon the exposed ledge in order to determine the best location for a permanent shaft.

Gold Dollar—This company expects to build a 100-ton cyanide mill, commencing work this spring. The property has been well developed.

Homestake—Preliminary work has commenced upon the 1700-h.p. hydroelectric plant at Spearfish creek. At least two years will be required for its completion.

Utah

BEAVER COUNTY

Mammoth—A drift from the 60-ft. shaft shows a 4-ft. ledge on a lime-granite contact. The ore carries lead, gold and silver.

SALT LAKE COUNTY

Dalton & Lark—The machinery is being overhauled and repaired and the pipe line over the hill will be placed in the Mascotte tunnel. It will probably be a month before the mine is in shape for active development.

Yampa—The smelter produced 5,500,000 lb. of copper during 1908. The plant is now producing about 1,000,000 lb. of copper per month at an estimated cost of about 8c. per pound.

SAN PETE COUNTY

Golden Reef—When the shaft reaches a depth of 250 ft., a crosscut is to be run to explore the vein encountered above.

Virginia

WASHINGTON COUNTY

Virginia Iron, Coal and Coke Company—Material for relining and otherwise repairing the blast furnace at Bristol has been received. The repair work will cost $75,000.

Washington

KITTITAS COUNTY

Skookum Copper—The Government has granted this company, operating in the Cle Elum district, permission to cut all timber required in constructing 16 miles of wagon road to the mine, and its new 250-ton concentrating plant. Work is progressing rapidly.

SNOHOMISH COUNTY

Wayside—This mine, near Granite Falls, under the management of Receiver Ned Hawkins, has encountered an orebody in the seventh level by a crosscut 12 ft. from the bottom of the shaft. The exposure shows 2 ft. of good ore. At the present time the deepest working is 500 ft. below sea level.

West Virginia

BRAXTON COUNTY

Cosmopolitan Coal and Coke Company—A controlling interest in this company has been sold to S. P. Boyd, representing Pittsburg parties. It is reported that the transfer is in the interest of the Steel Corporation. The company owns 11,600 acres of land in Braxton county, running over into Marshall county. It has a mine and coke plant at Gilmer.

Wisconsin

ZINC-LEAD DISTRICT

Highland—Jack and bone were struck at a depth of 37 ft. on the Whalen farm, two miles southeast of the village; the ore occurs in a disseminated vein and is a continuation of the Burrichter range. A deposit of white bone is being developed on the Manning property two miles west of Highland. In prospecting on the Tormey lot of the famous Crooked End, the Highland Mining Company struck 2 ft. of bone. This company is also prospecting on the Whalen 80, north of the village. Both of the company's mills have been idle for two months, but the smaller plant will start running next week. The Franklin has opened up a rich deposit of bone on the Leuke tract; the company has over 600 tons of this ore in surface dump and will begin milling as soon as the weather settles.

Platteville—The Wisconsin Zinc Company will construct a mill on the Mitchell Hollow some time this spring; the ore has been crosscut 50 ft., the main sheet measuring 8 to 12 in. thick. The Gogebic, just west of the Kohinoor blende, will be opened up by shaft. The Homestead has completed its roasting plant. Over 500 tons of green concentrates are accumulated in the bin. Shipments from Platteville have been light the last three weeks, on account of bad roads. A few companies are holding for better prices, among them the Wisconsin Zinc Company, which alone has 1000 tons of green concentrates in bin.

Rewey—Mifflin—The shaft on the Ellsworth land reached the top of the pitch at 82 ft., showing lead and jack in sheet form. The Big Tom has completed shaft-sinking at 115 ft. and is following a 4-in. sheet of jack and lead toward drill holes which indicated a heavier deposit. The 50-ton mill on the Squirrel has been completed; the mine has a 14-in. sheet of jack. The Union Zinc Company has connected its new shaft and mill by 300 ft. of tram and will resume work in mine and mill. The mines in this camp which are producing regularly include the Coker, Sunrise, Senator, Gruno, Peni, Peacock and Slack; 50 per cent. of the production goes to the separating plants at Platteville and Galena.

Canada

ALBERTA

The population within a radius of 15 miles of Frank, in southwest Alberta, is estimated at between 9000 and 10,000. Farther north, within a similar radius of Bankhead, there is a population estimated at about 5000. In both districts coal mining is the chief industry, and its development in recent years has brought in the larger part of the population.

The joint meeting of representatives of the Coal Mine Operators Association of western Alberta and eastern British Columbia, and the United Mine Workers of America, recently opened at Macleod to formulate a new agreement to take the place of that to expire on March 31, has been adjourned until March 16, to allow F. H. Sherman, president of the local district of the mine workers to take an active part in the provincial election campaign now in progress.

BRITISH COLUMBIA

Official figures, compiled from returns received, show that the correct production of coal and coke in 1908 was practically as stated in the estimate published in the JOURNAL of Jan. 30. The revised figures show the production of coal to have been

1,678,000 long tons and of coke 247,400 tons.

The quantity of ore produced in the Boundary and Kootenay districts during the months of January and February was: Boundary district, 258,000 tons; East Kootenay, 17,000; West Kootenay—Ainsworth & Slocan, 16,500; Nelson, 9500; Rossland, 32,000; total 333,000 tons. This includes copper, gold and silver-lead ores.

Crows Nest Pass Coal Company—At the annual meeting held in Toronto March 12, sweeping changes were made in the directorate. G. G. S. Lindsey, president and managing director; Hon. Robert Jaffray, vice-president; E. R. Wood and Sir Henry Pellatt all declined reëlection. The new board of directors consists of Elias Rogers, Toronto; Colonel Clough, New York; J. P. Graves, Spokane, Wash.; W. F. Robertson, Granby, B. C.; E. C. Whitney and H. B. McGiverin, Ottawa, and R. N. Young, Toronto. Mr. Young is secretary. It is understood that Sir Henry Pellatt has sold his large block of stock in the company to James J. Hill, so that the control now rests with the Great Northern Railway and the Granby Copper companies.

British Columbia—Vancouver Island

Two new coaling ports are to be established on the east coast of Vancouver island—one at Boat harbor, about six miles north of Oyster harbor, which is the shipping port of the Wellington Colliery Company's Extension mines, and the other at Hardy bay, in the northern part of the island. The South Wellington Coal Mines, Ltd., George Wilkinson, Nanaimo, superintendent, has opened a coal mine near Nanaimo, and is installing a tipple of 1000 tons daily capacity, constructing a tramway seven miles to Boat harbor, and erecting bunkers and loading plant at the shipping point. The Hardy bay port is required chiefly for the shipment of coal from mines being opened in its vicinity, both on Vancouver and Malcolm islands.

Ontario—Cobalt District

Ore Shipments—Shipments of ore from Cobalt for the week ended March 6 were: Buffalo, 45,210 lb.; Chambers-Ferland, 60,000; Crown Reserve, 62,220; City of Cobalt, 75,000; Coniagas, 62,500; La Rose, 195,000; Nipissing, 384,410; Peterson Lake, 51,400; Temiskaming & Hudson Bay, 60,000; Trethewey, 60,000; total, 1,055,740 pounds.

Dividends—Recent dividends of Cobalt companies are: City of Cobalt, 3 per cent., quarterly, April 15, on the new capitalization of $1,500,000. Crown Reserve, 6 per cent. quarterly and 9 per cent. bonus, March 31. Temiskaming, 6 per cent., quarterly, April 1.

Chambers-Ferland—In crosscutting at the 80-ft. level in No. 2 shaft a new Cobalt vein was encountered March 11, which is 4 to 6 in. in width. Considerable high-grade ore is being extracted at the 150-ft. level of No. 1 shaft, where drifting north and south is being carried on.

Columbus—A 2-ft. body of galena has been encountered at a depth of 250 ft., and 51 ft. east of the shaft.

Hargrave—A tunnel is being driven in to cut a strong vein known as the West Center vein, being started about 100 ft. below the apex of the vein. A shaft has been put down 170 ft., from which a crosscut will be run to strike the rich No. 3 vein of the Kerr Lake, which runs into the Hargrave location.

Station Grounds—This company has commenced operations from the main underground workings of the Cobalt Lake Company with power supplied by the latter.

Mexico

Chihuahua

American Smelting and Refining Company—Three furnaces are in blast at the Chihuahua smelter. It is stated that owing to the diversion of ore hitherto going to the El Paso plant, makes necessary the early erection of two additional furnaces whereby the plant's capacity will be about 1250 tons daily.

San Toy—Shipments have been curtailed on account of fire destroying the lower tramway terminal and it will be several weeks before normal production will be resumed. During the last few weeks the average grade of the ore has been somewhat higher, due to opening the new orebodies.

Dolores—The recently published annual report shows the earnings for the year ending June 30, 1908, to have been $360,359, the total income being $863,096 and the total expenditures $502,737.

Hidalgo—This Parral company has purchased the Nopal mine on the Veta Colorado lode. This acquisition is important inasmuch as it gives the company a mile of connected workings. Experiments are now being prosecuted with the view of erecting a cyanide plant. James I. and R. J. Long are at the head of the enterprise.

Mines of Mexico—Plans are announced for the installation of a large electric power plant utilizing the waters of the Mayo river in the Sierra Madre mountains. The company has a large mineral and timber tract in the Los Otates section. The control of this company is in the hands of Denver men, among whom are W. G. Boyle and W. O. Temple.

Mexican Northern Electric—This is a Canadian concern, lately organized in Montreal for the development of electric power throughout Mexico, and especially the La Joya site on the Conchos river. The largest stockholders are to visit Mexico during March.

International Oil and Gas—This Indianapolis company expects to begin active drilling operations on its concessions in eastern Chihuahua. The managing director, G. A. Deitch, general manager, A. M. Nelson and secretary, C. R. Troxel are now on the ground.

Sierra Madres—An unfortunate water shortage is reported in the western part of the state. The Otates and Santa Brigida mines have closed down and others, including the Rio Plata and Watterson, are using, to full capacity, their auxiliary steam plants. It is a number of years since so dry a season has been known and with the very light snowfall the indications are that the summer's operations at a number of mines must necessarily be curtailed.

Rio Plata—The report of January operations is as follows: Net returns on shipments, $27,568; concentrates production, 60,190 ounces silver; operating expenses, $8270; paid on account mine indebtedness, $19,298, leaving a total mine indebtedness Feb. 1 of $71,434. The power plant will be in readiness early in April when the completed cyanide plant will start on the accumulated tailings.

Parral Production—The output of the Parral camp for the week ending Feb. 26 was 9855 tons and for the following week 9390 tons. The February output was 45,000 tons as compared with 43,574 tons for January.

Sonora

Greene Gold-Silver—The directors, who are being sued by the New York State receiver to recover something like $49,000 in dividends alleged to have been paid out of assets, have put the company into bankruptcy in West Virginia, where the concern is incorporated.

Martin Conboy of counsel for the directors said yesterday that the Federal bankruptcy proceedings would in no way interfere with the action of creditors against the directors. The directors in their answer to the New York State receiver's suit have taken the ground that in declaring dividends they acted on information of the company's condition supplied by Colonel Greene and the proper officers of the company, which they believed to be correct and given in good faith.

New Caledonia

Exports of ores from New Caledonia for December and the year ended Dec. 31 are reported by the *Bulletin du Commerce*, of Noumea as follows, in metric tons:

	December.	Year.
Nickel ore	5,115	120,028
Cobalt ore	.....	3,405
Copper ore	.....	10
Iron ore	10	64
Chrome ore	.....	46,309

In addition there were reported for the year shipments of 5 tons lead and 5020 kg. silver.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, March 17—The coal trade in the West is beginning to take on a more hopeful tone. This is a result of increased orders for steam coal which have appeared in some quarters. Mines are generally making better time, though shipments to consuming centers are still restricted in order to prevent accumulations which will reduce prices.

The bituminous trade in the East is beginning to wake up a little, though it is still inclined to be rather irregular. However, taken as a whole, an improvement is manifest and there is little doubt that more coal has been sold.

The anthracite trade depends entirely on the negotiations for a renewed agreement. Just now everything is in the air, and the miners and operators alike are uncertain whether there will be a general stoppage of mining or not. Opinions vary widely and there is really nothing to base positive predictions upon. Notes on the situation will be found on another page.

The coke trade has had rather a setback, the increase in production having called out a larger supply than was really needed at the present time.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to March 6, short tons:

	1908.	1909.	Changes.
Anthracite	941,086	838,722	D. 102,364
Bituminous	5,869,931	6,157,234	I. 287,303
Coke	1,302,635	1,799,500	I. 496,865
Total	8,113,652	8,795,456	I. 681,804

The total increase thus far this year was 8.4 per cent.

Coal and coke tonnage, Chesapeake & Ohio railway, seven months, July 1 to Jan. 1, short tons:

	Coal.	Coke.	Total.
New River	3,849,142	135,529	3,984,671
Kanawha	3,068,051	17,689	3,085,740
Kentucky	210,232	.....	210,232
Connecting lines	151,995	44,489	196,484
Total	7,279,420	197,707	7,477,127
Total, 1907-08	6,855,741	224,860	7,080,601

Deliveries this year to points west of mines, 3,816,156 tons coal and 116,834 coke; points east, 905,101 tons coal and 80,873 coke; tidewater, 2,552,911 tons coal; anthracite to line points, 5252 tons.

Shipments of coal for the year ended Dec. 31 from the Cumberland region—including the North Potomac basin—are reported as follows: Baltimore & Ohio, 2,554,779 tons; Pennsylvania Railroad, 354,613; Western Maryland, 1,886,257; Chesapeake & Ohio Canal, 190,336; used at mines and sold locally, 798,606; total, 5,784,591 tons. The total in 1907 was 7,360,336; the decrease last year, 1,575,745 tons, or 21.4 per cent. The largest shippers in 1908 were the Consolidation Coal Company, 1,938,569; Davis Coal and Coke Company, 1,765,789 tons.

New York

March 17—The anthracite trade is quiet so far as domestic sizes are concerned. The strike talk has produced much uncertainty, but everyone believes that the companies have sufficient stocks of the large sizes to carry them through. Steam sizes, on the other hand, are scarce and in demand. Consumers of these sizes are anxious to put in stocks ahead if possible, but the production has been moderate for some time, and the companies are holding back considerable quantities at the mines in order to be supplied with fuel for pumps, etc., in case of a stoppage.

The usual April discount of 50c. has not been announced and probably will not be until something definite is known. Prices continue nominally unchanged, but dealers and agents are getting from 5 to 15c. per ton advances on pea and buckwheat. The list prices for prepared sizes are $4.75 for broken, and $5 for egg, stove and chestnut. Small steam sizes are: Pea, $3.25@3.50; buckwheat No. 1, $2.35@2.50; buckwheat No. 2 or rice, $1.60@2; barley, $1.35@1.50; all f.o.b. New York harbor points.

Bituminous

The soft-coal market is not exciting. There has been a little improvement, but it is irregular and trade is very bunchy. Nevertheless, there is an improvement which is noticed most by the commission houses. Orders are generally for as quick delivery as possible, indicating that stocks are low. Some more contracting has been done, but slowly and with a good deal of dickering. A number of contracts are about 25c. below last year. The best trade just now is coming from the Sound, but the far East is reported to be pretty well cleared out of coal.

All-rail trade continues to hold its own fairly well. Transportation is fully up to schedule and car supply abundant. New York harbor is a little irregular, but prices remain unchanged at $2.40@2.50, f.o.b. harbor shipping points, for good steam coal, with lower grades about 20c. less.

In the Coastwise trade vessels are slowly coming out of winter quarters and captains are actively hunting for charters, which has brought about a decline in rates to a very low point. We quote for large vessels from Philadelphia: To Boston, Salem and Portland, 70c.; Lynn and Bath, 75c.; Portsmouth, 75c.; Newburyport, 80c.; Providence, New Bedford and the Sound, 55c. The peg of 75c. for around Cape Cod has at last been removed.

Birmingham

March 15—The coal trade in Alabama continues dull with no indications of an early improvement.

During the past week State Mine Inspector Flynn gave out some official figures as to the coal production in Alabama during 1908. A few mines are yet to be heard from which, it is estimated, will add about 500,000 tons to the figures now worked up. The figures in hand already total 10,474,591, against 14,424,863 tons in 1907. There were 118 men killed in the coal mines of Alabama during the year.

The coke production, which was reduced a few weeks since, will shortly be started up again, several batteries of ovens resuming operation shortly. The Tennessee company still has a large quantity of coke stacked up.

Chicago

March 15—Firmness exists in all branches of the coal trade. For steam uses both Western and Eastern coals find a quietly improving market; the domestic trade has dwindled to a condition of week-to-week supply. The market is notably bettered as to demurrage troubles. Little coal is depressed by reason of too great shipments and forced sales.

Contract business shows fair bookings to date, but the old trouble exists in the realization by consumers that retail prices will probably continue low because of large production and relatively small consumption. Fine coals show stronger tendencies with the advance of spring conditions.

Prices show little change. Illinois and Indiana lump and egg is quoted at $1.75@2.40; run-of-mine at $1.60@1.75 and screenings at $1.25@1.55. Eastern coals show a firmer tendency; smokeless Pocahontas and New River lump bringing $3.15@3.45 and run-of-mine $2.85@3.15; lower-grade smokeless sells for $2.95@3.30, lump or egg, and $2.85@3, run-of-mine. Hocking coal has been withheld from this market, with the result that it is made firmer,

selling for $3@3.15. Youghiogheny is quiet and steady at $2.15 for ¾-in. gas, and Pittsburg No. 8 brings $2.75@2.85 for the same size.

Anthracite is very dull. The threats of labor troubles have not yet affected the market.

Cleveland

March 16—Prospects are not good for an early opening of Lake trade. Reports from the Northwest are that there are still large stocks of coal, which are being drawn on very slowly. Shippers are holding back on charters until they can get some line on probable demand.

Local coal trade is dull and there is a surplus supply, which has made prices weak. Eastern Ohio ¾-in. can be had around $1 at mine, and slack at 55c. Some sales of slack are reported at 50c. at mine.

Indianapolis

March 15—The most encouraging feature of the coal-mining industry in this State is the increasing demands for coal, which kept the mines running more regularly during the past week than for some time. This condition has occasioned the operators to become more optimistic. There is little or no fluctuation in prices and no attempt is made to secure large contracts by shading prices at the mines. The loss of a large amount of Pennsylvania coal by the sinking of barges in the Ohio river near Evansville, has occasioned quite a stiff demand for Indiana coal to supply the demand for lower river towns.

Pittsburg

March 16—Few mines in the district, outside of the river mines, are running more than three days a week, and production at the railroad mines in the district is estimated at about 30 per cent. of capacity. No large contracts have been made, and orders are for small tonnages compared to the buying formerly at this season of the year. Prices are being firmly held by the large producing interests on the basis of $1.15 for mine-run coal at mine. This price, however, has been shaded by small operators. The river mines continue to run full, and there are plenty of empty coal boats and barges. Several tows were sent out during the week, cleaning up all the coal that was ready for shipment.

Connellsville Coke—There is no improvement in the trade. Lower prices are being quoted, but this has not induced buying. Sales of spot furnace coke have been made as low as $1.50, but on contract the price is being held by large producers at $1.75. Foundry coke for prompt shipment has declined to $1.90, and it is believed contracts can be made at that rate until July 1; but the regular contract quotation ranges from $2@2.15. The *Courier* gives production in both fields at 260,987 tons. The shipments were 9427 cars as follows: To Pittsburg district, 3138; to points west of Pittsburg, 5543; to points east, 746 cars.

Foreign Coal Trade

Austrian Coal Trade—Imports and exports of fuel in Austria-Hungary, year ended Dec. 31, metric tons:

	Imports.	Exports.	Excess.
Coal	9,995,289	768,445	Imp. 9,226,844
Brown coal (lignite)	30,432	8,596,104	Exp. 8,565,672
Coke	851,098	183,278	Imp. 667,820
Briquets	106,516	100,264	Imp. 6,252
Total	10,983,335	9,648,091	Imp. 1,335,244
Total, 1907	10,538,619	10,140,841	Imp. 397,778

The total increase in imports in 1908 was 4.2 per cent.; the decrease in exports, 4.9 per cent.

French Coal Production—Output of the Nord and Pas-de-Calais—the two chief coal-producing districts of France—for the full year was, in metric tons:

	1907.	1908.	Changes.
Coal mined	24,738,628	25,521,605	I. 782,977
Coke made	1,946,757	1,781,347	D. 165,410
Briquets made	1,191,297	1,339,817	I. 148,520

Of the coal mined in 1908 the Nord furnished 6,963,774 and the Pas-de-Calais 18,557,832 tons.

Welsh Coal Prices—Messrs, Hull, Blyth & Co., London and Cardiff, report current prices of coal as follows, on March 6; Best Welsh steam, $3.36; seconds, $3.24; thirds, $3.12; dry coals, $3.48; best Monmouthshire, $3.06; seconds, $2.94; best small steam, $2.10; seconds, $1.86. All per long ton, f.o.b. shipping port.

Iron Trade Review

New York, March 17—The iron and steel markets generally have lapsed into rather a waiting condition. While price considerations have more immediate effect than the tariff revision, there are quite a number of buyers who deem it prudent to wait until something definite is known. No one expects that there will be any heavy importations of iron and steel, but the reduction of the tariff may have a considerable effect upon prices. The first draft of the new tariff bill, made public today, proposes large reductions in duties on pig iron and steel, and a removal of the duty on iron ore. These changes had been expected.

Pig iron has been more active and quite a number of contracts have been placed for foundry and basic. These are being generally taken at a reduction, mostly for immediate delivery, very few of them running beyond June. Southern furnaces have been rather scrambling for orders, and several contracts have been reported taken at $11.50 and even $11 Birmingham, for No. 2 foundry. On the other hand, some of the large companies have declined to take less than $12, Birmingham. Virginia furnaces have also cut the prices, but Northern merchant furnaces are rather inclined to hold back.

Finished material has been only moderately active, with the exception of structural steel. A number of contracts have been placed for building material and there seems to be a general disposition to go ahead with bridge and building projects.

The Pennsylvania and the Maryland steel companies have announced reductions of 10 per cent. in wages. It now seems probable that other companies will follow the same course. The Steel Corporation has made no announcement as to its intentions.

Iron-ore Movement—Imports and exports of iron ore in the United States, month of January, long tons:

	1908.	1909.	Changes.
Imports	57,659	105,233	I. 47,574
Exports	5,463	4,225	D. 1,238

Of the imports this year 70,525 tons were from Cuba; the balance from Newfoundland and Spain.

Imports of manganese ore in January, 35,019 tons in 1908, and 14,942 in 1909; decrease, 20,077 tons.

Baltimore

March 16—Exports from the port of Baltimore for the week included 876,646 lb. scrap tin to Rotterdam. Imports included 1061 tons ferromanganese and 125 tons manganese ore from Liverpool; 119 tons manganese ore from Rotterdam; 7581 tons pyrites from Spain; 10,100 tons iron ore from Cuba.

Birminghan

March 15—There is a better sale of iron going on in the Southern territory, but the market is still quiet. There is some improvement noted. Quotations are still weak—$12 per ton, No. 2 foundry—but hardening, though there is a report that one or two companies are still selling under that figure. One or two companies are holding out for $12.50 per ton. The cast-iron pipe concerns in this territory have a large amount of business in hand and have recently received other orders that warrant a steady operation through the balance of the year and longer. The pipe makers have been the best patrons in the last few months of the Southern furnaces. There has been no reduction in the make of iron in this district.

All kinds of reports are current in reference to the Ensley steel plant of the Tennessee company, shutting down April 1. There is no denial or verification. There is some accumulation of steel, though it is understood that the rolling mills of the company at Bessemer, Ala., will resume operation shortly and will use considerable steel.

Chicago

March 15—The iron market is gradually assuming confidence as regards manufactured products, and is buying well. As regards pig iron only slight improvement is

visible; the ordinary consumer prefers yet to buy from hand to mouth. He will not take, as a rule, more than a carload to 200 tons at a purchase, and he will not buy even so small an amount unless he can see use for the iron within the next three months. This condition seems bound to continue, for the subject of tariff legislation seems to be uppermost in the minds of all melters of iron. They are speculating little on possible changes.

Prices remain vague. Some Southern iron is said to have sold below $12 Birmingham ($16.35 Chicago), but that figure is still quoted nominally and doubtless represents some transactions. Northern at $16.50 remains firm in general; special contracts may receive lower quotations, but not the average consumer. Business for the second half is generally regarded as non-existent. Lake Superior charcoal sells for $19.50, with fair demand.

Coke is somewhat firmer, the best Connellsville bringing $4.85 with shipments well held down.

Cleveland

March 16—Nothing definite has yet been done about ore prices. Some small sales have been made by an outside interest at last season's prices, but this is not considered as of importance, so far as the general market is concerned.

Pig iron is dull, and only some small local sales have been made, chiefly of foundry. Prices have been around $16, Cleveland, for No. 2 foundry, and $14 for gray forge.

In finished material business is growing, and a number of transactions are reported. Individual orders are not large, but the aggregate is increasing considerably.

Philadelphia

March 17—The past week has been almost lifeless, so far as pig iron is concerned. A few of the larger consumers, among which were several foundry interests, made propositions a week ago to buy special iron but withdrew them suddenly. Makers of pig iron are showing a desire to secure business, but are not able or willing to make any further concessions than those announced two weeks ago. The forge iron buyers are absolutely out of the market.

Steel Billets—The reduction in steel billets has led to the opening of negotiations or inquiries as to how far ahead manufacturers will be willing to make deliveries if orders are placed at this time.

Bars—Steel bars have been selling somewhat better within the past week and mills are now running on fair sized orders. There is also some additional business in common iron for the general trade; refined is weak and quotations are 1.45@1.50c. Common has sold as low as 1.20@1.25c., tidewater.

Structural Material—Apart from some little inquiry nothing of importance has been done in this market in structural material.

Scrap—There is no activity and stock is accumulating. Several dealers are making efforts to get all the heavy cast scrap and railroad scrap they can get. Prices are weak.

Pittsburg

March 16—The unexpected determination of the Steel Corporation, through its tinplate subsidiary, to cut prices $5 per ton which was reached during the week after a careful consideration of the situation undoubtedly will prove of benefit to that interest. The independent concerns, however, were opposed to the cut and contend that it will seriously affect their trade unless a corresponding cut is made in tinplate bars. The recent cut in bars was but $2 per ton, making the price $25.50 delivered in Steubenville, Wheeling, Sharon, McKeesport and adjacent territory. If this rate is lowered it will be necessary to reduce steel billets, the price of which was fixed at $23, Pittsburg. To lower the billet price would increase the differential between billets and steel rails. Producers declare positively that these prices will not be disturbed, and that when the tariff legislation is ended conditions will immediately begin to improve.

As a result of the cut of $5 per ton, or 25c. a box, in the price of tin and terne plates the American Sheet and Tin Plate Company is preparing to start a number of idle mills. It has been running 164 tin mills for several weeks, and on Monday will increase the active mills to 213, the highest number operated in two years.

In finished steel the Carnegie Steel Company has taken on considerably more business since the readjustment in prices, and its capacity is being increased. One of the two new blast furnaces which were added to the Duquesne group was blown in this week, and the other will be started in a short time. The company is now operating 35 of its 59 blast furnaces. Rail business is dull, and the three mills at the Edgar Thomson works are only being operated at about 40 per cent. of capacity.

Pig Iron—The market is practically dead, and unusually low prices are being named in order to induce buying. Some furnaces are quoting standard bessemer at $14.75; malleable bessemer, basic and No. 2 foundry at $14.50; gray forge at $13.50, all at Valley furnaces. Other quotations are 25c. a ton higher, but there have been no sales of any consequence outside of one lot of 1000 tons off bessemer bought by the Westinghouse Air Brake Company at $14.60, Valley.

Steel—Sales are light and prices unchanged as follows: Billets, $23, Pittsburg; sheet-bars and tinbars, $25.50; merchant-steel bars, 1.20c., and plates, 1.40 cents.

Sheets—Some new business is being placed at the ruling quotations, which are 2.30c. for black, and 3.30c. for galvanized sheets, No. 28 gage.

Ferro-manganese—Prices are much lower, $41@41.50 being quoted.

Metal Market

New York, March 17—The metal markets continue in about the same condition as last week.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Feb. 1909..	$ 8,860,814	$ 3,576,413	Exp. $5,284,401
" 1908..	1,967,597	2,847,133	Imp. 879,536
Year 1909..	16,726,170	6,996,596	Exp. 9,729,574
" 1908..	2,411,797	13,646,617	Imp. 11,234,820
Silver:			
Feb. 1909..	4,852,549	3,508,881	Exp. 1,343,668
" 1908..	4,108,774	3,451,755	" 657,019
Year 1909..	9,394,643	7,173,633	" 2,221,020
" 1908..	8,256,918	7,073,629	" 1,183,289

Exports from the port of New York, week ended March 13: Gold, $3,823,050, chiefly to Argentina; silver, $829,490, to London and Paris. Imports: Gold, $608,250, from France, Central and South America; silver, $89,037, from the West Indies and Mexico.

Foreign commerce of the United States, two months ended Feb. 28, reported by Bureau of Statistics, Department of Commerce and Labor:

Merchandise:	1908.	1909.
Exports	$ 373,871,750	$ 282,720,414
Imports	169,750,165	222,243,508
Excess, exports	$ 204,121,585	$ 60,476,906
Add excess of exports, silver		2,221,020
Add excess of exports, gold		9,729,574
Total export balance		$ 72,427,500

The gold and silver movement in detail is given in the table at the head of this column.

The Treasury Department's estimate of the amount and kinds of money in the United States on March 1 is as follows:

	In Treasury.	In Circul'n.
Gold coin (inc. bullion in Treasury)	$ 186,394,881	$ 609,988,359
Gold certificates	47,699,690	812,642,179
Silver dollars	6,878,913	72,158,899
Silver certificates	13,342,608	471,411,392
Subsidiary silver	24,855,000	130,767,140
Treasury notes of 1890	15,336	4,452,664
U. S. notes	10,922,510	335,758,506
Nat. bank notes	30,686,733	647,598,867
Total	$320,795,671	$3,084,778,006

Population of the United States March 1, 1909, estimated at 88,448,000; circulation per capita, $34.88. The total circulation March 1 was 7,888,635 less than on March 1 of last year.

Gold and silver movement in France, year ended Dec. 31:

	Imports.	Exports.	Excess.
Gold..	Fr.1,013,750,000	F.23,379,000	Imp.Fr.990,371,000
1907...	444,431,000	154,573,000	Imp. 289,858,000
Silver..	174,090,000	175,893,000	Exp. 1,794,000
1907...	360,860,000	215,501,000	Imp. 145,359,000

Imports of copper and nickel coins, 109,000 fr. in 1907, and 73,000 fr. in 1908; exports, 703,000 fr. and 753,000 fr., respectively.

Gold and silver movement in Great Britain, month of January:

	Imports.	Exports.	Excess.
Gold	£ 3,228,260	£ 5,460,845	Exp. £2,232,585
Gold, 1908	3,225,392	2,938,590	Imp. 286,802
Silver	1,210,533	1,033,670	Imp. 176,863
Silver, 1908.	569,555	1,436,570	Exp. 867,015

The excess of exports of gold and of imports of silver shown this year are both unusual conditions.

Gold—There has been no special demand for gold on the open market in London and prices remain at the mint value, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American eagles. The Bank of England has absorbed most of the supplies. In New York shipments have been made this week of $2,400,000 to Argentina and $2,500,000 to London; while it is reported that more will go on Saturday.

Platinum—Business has been a little better, but there are no signs of any change in price soon, though there is an impression that higher prices will come when demand improves. Dealers quote $24 for refined platinum, $26 per oz. for hard metal and $19@21 for scrap.

Our special correspondent writes from St. Petersburg, under date of Feb. 18, that expectations of higher prices have not been realized, and large dealers now believe that there will be no change for some time. Crude platinum, 83 per cent. metal, is quoted at Ekaterinburg 5 rubles per zolotnik; in St. Petersburg, 20,000 rubles per pood. These prices are equivalent to $18.80 and $19.55 per oz., respectively. The annual conference of the Ural platinum miners, held at Ekaterinburg, Feb. 6-9, decided to petition the Government to make loans to miners at the rate of 16,000 rubles per pood of crude platinum.

Silver—The market has remained quite steady. The fluctuations have been slight, and the tendency is toward a movement within a small compass.

SILVER AND STERLING EXCHANGE.

Mar.	11	12	13	15	16	17
New York	50⅜	50⅛	50¾	50⅝	50¾	50½
London	23⅝	23¼	23½	23⅝	23½	23¼
Sterling Ex.	4.8810	4.8810	4.8810	4.8815	4.8820	4.8820

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Exports of silver from London to the East, reported by Messrs. Pixley & Abell, year to March 4:

	1908.	1909.	Changes.
India	£ 1,400,538	£ 818,200	D. £ 582,338
China	496,400	240,000	D. 256,400
Straits	78,270	82,000	I. 4,530
Total	£ 1,975,208	£1,141,000	D. £ 834,208

Imports for the week, £3000 from Mexico and £200,000 from New York; total, £203,000. Exports, £22,000 coin to the Straits and £6000 in bars to India; £28,000 in all.

Copper, Tin, Lead and Zinc

Mar.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
11	12¼ @13	12¼ @12⅜	56	29	3.97½ @4.00	3.82½ @3.85	4.60 @4.62½
12	12½ @13	12⅜ @12⅝	55⅞	29	3.97½ @4.00	3.82½ @3.85	4.60 @4.62½
13	12½ @13	12⅜ @12⅝	....	28¾	3.97½ @4.00	3.82½ @3.85	4.60 @4.62½
15	12½ @12¾	12⅜ @12¼	54¾	28½	3.97½ @4.00	3.82½ @3.85	4.60 @4.62½
16	12½ @12¾	12 @12¼	54⅞	28¾	3.97½ @4.00	3 82½ @3.85	4.60 @4.62½
17	12½ @12¾	12 @12¼	55¼	28½	3.97½ @4.00	3.82½ @3.85	4.60 @4.62½

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—The singular lack of interest which domestic consumers show in the present low level of prices has created considerable nervousness among selling interests. The selling pressure concentrated upon Europe, some business in electrolytic for export thither being done from day to day at receding prices, though the tonnage was relatively unimportant, owing to the fact that European buyers had well supplied themselves during the activity of about two weeks ago. Little or no business in Lake copper has been done, and quotations for that quality are nominal, the producers being in no way prominent in the market. The market closes barely steady at 12½@12¾c. for Lake copper; 12@12¼c. for electrolytic in ingots, cakes and wirebars. The average of the week for casting copper has been 12@12⅛ cents.

Copper sheets, cold-rolled, are quoted 17.3c. per lb., large lots; and hot-rolled, 16.5c. Copper wire, 14¼c. base, carload lots at mill.

After holding fairly steady until the close Friday, the London standard market opened on Monday with a sharp decline, and on the second exchange on that date reached the lowest figures, £54 15s. for spot, £55 10s. for three months. Since then, under bear covering, there has been a recovery, the close being steady at £55 5s. for spot, £56 for three months.

Statistics for the first half of the current month show an increase in the visible supplies of 100 tons.

Refined and manufactured sorts we quote: English tough, £59 10s.; best selected, £58 10s.@£59 10s.; strong sheets, £70 10s.@£72 10s.

Copper exports from New York and Philadelphia for the week were 5538 long tons. Our special correspondent gives the exports from Baltimore for the week at 1028 tons of copper.

European stocks on March 1 are reported as below, in long tons, by Henry R. Morton & Co., of London:

Visible stocks, Feb. 1	52,935
Supplies during February	24,653
Total	77,588
Deliveries in February	25,293
Stocks, March 1	24,295

Stocks include 38,242 tons in England; 6253 tons in France; 7700 tons afloat from Chile and Australia.

Tin—The bull party in London suddenly turned sellers, and prices consequently declined. The reasons for this change of front are not given, and it is hard to follow the tactics of these London speculators. The market closes steady at £129 for spot, £130 12s. 6d. for three months.

There is very little activity in the domestic market, the only remarkable feature being an over-supply of spot material which is pressed for sale. The quotations at the close are made at 28½ cents.

Lead—The market has quieted down after some large transactions early in the week, but is holding well, as the recent activity has taken care of the cheap offerings and sellers can afford to be independent. The close is steady at 3.82½ @3.85c. St. Louis, 3.97½@4c. New York.

The London market has been depressed throughout the week and the close is cabled at £13 5s. for Spanish lead, £13 7s. 6d. for English lead.

Spelter—Business has again fallen off to minimum proportions. On the one hand, consumers are well supplied, and, on the other, there is no pressure to sell. The close is steady at 4.60@4.62½c. St. Louis, 4.75@4.77½c. New York. The New York price was 4.75@4.77½c. throughout, March 11-17, inclusive.

The London market has again declined, and the close is cabled at £21 5s. for good ordinaries, £21 10s. for specials.

Base price of sheet zinc is now 6¾c. per lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

The New Jersey Zinc Company announces that after March 22 its offices will be in the National City Bank building, 55 Wall street, New York.

Other Metals

Antimony—Business is extremely quiet. Prices nominally unchanged at 8@8⅛c. for Cookson's; 7⅞c. for Hallett's; 7⅜@7⅝c. for ordinary brands.

Aluminum—Nothing new is reported. The Aluminum Company of America still quotes 24c. base for No. 1 ingots; 33@34c. base for sheets.

Quicksilver—New York quotations, $45 @46 per flask of 75 lb. Business continues fair. San Francisco nominal at $45 for domestic, and $43 for export. London,

£8 7s. 6d. per flask, with £8 6s. 3d. named by jobbers.

Nickel—Large lots, contract business, 40@45c. per lb. Retail, spot, from 50c. for 2000-lb. lots up to 55c. for 500-lb. lots. The price for electrolytic is 5c. higher.

Cadmium—Current quotation 75c. per lb., in 100-lb. lots, at Cleveland, Ohio.

Magnesium—Quotations for this metal are $1.25 per lb., New York, in 100-lb. lots; for 5-lb. lots, $1.40 per pound.

German Metal Imports and Exports

Imports and exports of metals in Germany for the full year are reported as follows, in metric tons:

	Imports.	Exports.	Excess.	
Copper	175,184	69,925	Imp.	105,259
Copper, 1907	144,002	62,511	Imp.	81,491
Tin	14,243	6,122	Imp.	8,121
Tin, 1907	13,020	6,848	Imp.	6,172
Lead	77,649	40,626	Imp.	37,023
Lead, 1907	75,200	38,259	Imp.	36,941
Zinc	35,003	97,008	Exp.	62,005
Zinc, 1907	29,843	93,649	Exp.	63,806
Nickel	3,119	1,604	Imp.	1,515
Nickel, 1907	2,294	1,265	Imp.	1,029
Aluminum	3,278	1,210	Imp.	2,068
Aluminum, '07.	3,974	1,926	Imp.	2,048
Minor metals	1,043	10,644	Exp.	9,601
Minor met's '07	980	9,679	Exp.	8,699

The totals include alloys and metals in manufactured form.

Imports and exports of metallic ores for the year were, in metric tons:

	Imports.	Exports.	Excess.	
Gold ore	180	.....	Imp.	180
Gold ore, 1907	95	.....	Imp.	95
Silver ore	1,742	5	Imp.	1,737
Silver ore, '07	3,506	47	Imp.	3,459
Copper ore	17,456	21,741	Exp.	4,285
Copp'r ore, '07	19,295	20,946	Exp.	1,651
Tin ore	11,420	29	Imp.	11,391
Tin ore, 1907.	9,971	31	Imp.	9,940
Lead ore	133,597	1,189	Imp.	132,408
Lead ore, '07	137,861	1,296	Imp.	136,565
Zinc ore	199,840	39,450	Imp.	160,390
Zinc ore, 1907	184,703	34,863	Imp.	149,840
Nickel ore	17,402	.....	Imp.	17,402
Nickel ore, '07	29,296	.....	Imp.	29,296
Tungsten ore	2,308	133	Imp.	2,175
Tung. ore, '07	2,239	195	Imp.	2,044
Other ores	2,618	603	Imp.	2,015
Other, 1907	6,073	929	Imp.	5,144
Chrome ore	16,975	111	Imp.	16,864
Chrome, 1907	19,508	148	Imp.	19,360
Pyrites	334,133	16,384	Imp.	317,749
Pyrites, 1907.	393,327	24,183	Imp.	369,144

Other ores include uranium, molybdenum and other minor metals, with some mixed or complex ores.

Zinc and Lead Ore Markets

Platteville, Wis., March 13—Prices continued the same as last week; $37.50 per ton being the basis paid for 60-per cent. zinc. No premium was paid. For 80-per cent. lead ore, $46 per ton was paid.

SHIPMENTS, WEEK ENDED MAR. 13

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Hazel Green	343,300	.....	281,050
Platteville	242,500	54,000	.....
Benton	221,570	.....	.....
Linden	168,810	.....	.....
Livingston	160,000	.....	.....
Galena	88,000	.....	.....
Strawbridge	88,000	.....	.....
Cuba City	82,640	.....	.....
Harker	39,230	.....	.....
Total	1,434,050	54,000	281,050
Year to Mar. 13	21,365,239	710,180	1,980,650

In addition to the above there was shipped to the American Zinc Ore Separating Company 190,410 lb. zinc ore.

Joplin, Mo., March 13—The highest price reported for zinc sulphide ore was $40 per ton, the base ranging from $35.50 to $38 per ton of 60 per cent. zinc. Zinc silicate sold at $25 highest, on base of $18@20 per ton of 40 per cent. zinc. Zinc, all grades, averaged $34.24 per ton. Lead sold as high as $50.50, the bulk of the ore selling around $50 averaging, all grades, $49.86 per ton.

The general decrease of the wage scale has made it possible for most of the mines to continue outputting on the present level of prices, even though the margin of profit is small; weather and general conditions are so favorable that the output continues to increase.

SHIPMENTS, WEEK ENDED MAR. 13

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	4,312,820	753,220	$ 96,460
Joplin	1,675,460	337,990	39,316
Miami	844,200	171,000	15,671
Alba-Neck	774,650	.....	14,330
Galena	617,290	95,200	13,581
Duenweg	717,740	12,790	12,894
Spurgeon	538,740	138,230	11,742
Oronogo	645,030	.....	11,138
Prosperity	416,390	109,040	10,220
Granby	646,360	2,300	7,715
Aurora	474,010	.....	7,054
Badger	295,680	19,310	5,930
Carthage	290,080	.....	5,366
Quapaw	213,270	9,020	3,632
Sarcoxie	224,250	.....	3,221
Carl Junction	109,490	4,210	2,182
Zincite-Sherwood	117,540	.....	2,115
Cave Springs	62,770	.....	1,161
Redds	44,180	.....	530
Totals	13,019,950	1,652,310	$264,258
Eleven weeks	122,109,580	18,401,780	$2,663,824
Zinc value, the week, $222,979; 11 weeks, $2,195,429			
Lead value, the week, 41,279; 11 weeks, 468,395			

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price.		Zinc Ore. All Ores.		Lead Ore. All Ores.	
	1908.	1909.	1908.	1909.	1908.	1909.
January	$37.60	$41.25	$35.56	$38.46	$46.88	$52.17
February	36.63	36.94	34.92	34.37	49.72	50.50
March	36.19	.....	34.19	.....	49.90	.....
April	35.40	.....	34.08	.....	52.47	.....
May	34.19	.....	33.39	.....	56.05	.....
June	33.06	.....	32.07	.....	60.48	.....
July	34.55	.....	31.67	.....	59.90	.....
August	36.53	.....	33.42	.....	60.34	.....
September	37.63	.....	34.44	.....	54.59	.....
October	35.95	.....	33.28	.....	52.63	.....
November	39.13	.....	35.02	.....	54.53	.....
December	42.75	.....	39.63	.....	49.68	.....
Year	$36.63	.....	$34.31	.....	$53.93	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Chemicals

New York, March 17—A fair amount of business is being transacted in small sales, although the market remains generally quiet.

Copper Sulphate—The market is quiet with no big sales reported. Prices hold at $4.60 per 100 lb. for carload lots and $4.85 per 100 lb. for smaller parcels.

Arsenic—Sales for the week amount to about 200 tons at 2⅞c. per lb. The market is not active and the price quoted is 3c. per lb. on white arsenic.

Nitrate of Soda—Quotations have been 2.15@2.17c. per lb. There has been some improvement in the market during the week.

Potassium Salts—Exports of potassium salts from Germany for the year are reported as below, in metric tons:

	1907.	1908.	Changes.
Kainit, kieserit, etc	839,889	818,569	D. 21,320
Potassium chloride	173,638	174,359	I. 721
Potassium sulphate	46,158	48,804	I. 2,646
Pot.-magnesium sulph'te	128,344	132,943	I. 4,599

Exports to the United States in 1908, included in the above totals, were 364,731 tons kainit, kieserit, etc.; 100,587 tons potassium chloride; 25,957 tons potassium sulphate; 59,869 tons potassium-magnesium sulphate.

Petroleum Exports

Exports of mineral oils from the United States, two months ended Feb. 28, in gallons:

	1908.	1909.
Crude petroleum	14,899,445	17,832,045
Naphthas	3,829,138	6,410,792
Illuminating oils	161,995,537	152,036,316
Lubricating oils	25,123,918	20,509,612
Residuum	9,673,416	12,061,498
Total	215,521,454	208,850,263

Paraffin is included in lubricating oils. The total decrease this year was 6,671,191 gal., or 3.1 per cent.

Mining Stocks

New York, March 17—The general stock market has been distinctly narrow with some tendency to weakness. This tendency, however, has not been so marked as the unwillingness to trade much at present and the desire to await further developments especially in the industrial field. The special session of Congress began on Monday and the Exchange seems to be holding back until it can see what turn the tariff legislation will take.

On the Curb trading was not very heavy. The copper shares displayed considerable weakness, and buyers were not strongly disposed to take them up. Other stocks followed this lead and were inclined to be weak on moderate trading but without any heavy actual loss in prices.

The Curb was stirred up on Monday by an unusual out-pouring of "cats and dogs." There was a sale of 190,565 shares in all, made to close out an account. The prices were something startling to those brokers who have memories long enough to remember the quotations of a year or two ago. Among them were the following: Nevada Exploration, 60,000 shares at $100 for the lot; Round Mountain Red Top, 35,000 shares at $100 for the lot; Roanoke, 3950 shares at $8 for the lot; Mohawk Extension, 1½c.; Gibraltar, 5½c.; Tramps Consolidated, 6c.; North Butte Extension,

4½c. Montgomery-Shoshone held up best of all, bringing $1.37½c. per share.

Boston, March 16—Notwithstanding the fact that there is little interest manifested in mining shares prices hold wonderfully well. The annual reports of the various mining companies, now coming out from time to time, show lean treasuries. As a rule it is a surplus of liabilities.

Parrot has been a strong feature, advancing $2.25 to $32.12½, with fractional setback from this. Favorable developments in the lower levels are coming from the property. North Butte rose from $67.50, ex-dividend, to $68.50 and Calumet & Hecla is off $15 to $610. Osceola is off $2 to $128. The 1909 annual meeting resulted in a complete change in the directorate, Calumet & Hecla officials taking the places of the old board. The same people have issued the call for the annual meeting of the Isle Royale when a complete change in the management will take place.

Utah Consolidated directors have declared the usual 50c. quarterly dividend. Arcadian showed activity and a degree of strength. Reports have been current of Calumet & Hecla interests in this property but there is no foundation for them.

Nipissing and Ohio Copper were the Curb features.

On the Curb market hereafter there will be two departments, stocks being known as "qualified" and "unqualified," according to the degree in which they meet the requirements of the governing committee.

STOCK QUOTATIONS

NEW YORK Mar. 17	
Name of Comp.	Clg.
Alaska Mine	.23
Amalgamated	68
Anaconda	41½
Balaklala	‡2⅛
British Col. Cop.	6⅜
Buffalo Mines	‡3
Butte Coalition	22¾
Colonial Silver	⅛
Cum. Ely Mining.	7¾
Davis Daly	4⅜
Dominion Cop.	‡.12½
Douglas Copper	2¾
El Rayo	2¾
Florence	3⅛
Foster Cobalt	.34
Furnace Creek	.11
Giroux	8⅛
Gold Hill	¾
Goldfield Con	7⅞
Granby	92¾
Greene Gold	¼
Greene G. & S.	7
Guanajuato	1¾
Guggen. Exp.	175½
Hanapah	.15
Kerr Lake	8⅛
McKinley Dar.	.85
Miami Copper	13½
Micmac	1¾
Mines Co. of Am.	¾
Mitchell Mining.	⅛
Mont. Sho. C.	1½
Nev. Utah M. & S.	2⅛
Newhouse M. & S.	3½
Nipissing Mines.	10⅝
Old Hundred	⅜
Silver Queen	.60
Stewart	⅛
Tennessee Cop'r.	41
Tri-Bullion	1¼
Union Copper	1⅞
Utah Apex	6⅛
Utah Copper	43¼
Yukon Gold	4⅛

*Ex. Div. †Ex. Rights.

BOSTON Mar. 17	
Name of Comp.	Clg.
Adventure	‡7½
Allouez	‡39½
Am. Zinc	‡25
Arcadian	‡5½
Arizona Com.	34¾
Atlantic	14½
Boston Con.	11¾
Calumet & Ariz.	100
Calumet & Hecla	610
Centennial	29½
Con. Mercur	‡.30
Copper Range	76
Daly-West	9¾
East Butte	14¼
Franklin	14
Greene—Can	9⅜
Isle Royal	26½
La Salle	14⅞
Mass	5
Michigan	10¼
Mohawk	60½
Nevada	17¾
North Butte	68¼
Old Colony	‡.60
Old Dominion	48¼
Osceola	128
Parrot	31¼
Quincy	‡85
Rhode Island	‡4¾
Santa Fe	2
Shannon	14
Superior	41½
Superior & Pitts.	13⅝
Tamarack	80
Trinity	13⅛
United Cop., com.	‡11⅞
U. S. Oil	31¼
U. S. Smg. & Ref.	40
U.S. Sm. & Re., pd.	45
Utah Con.	39¾
Victoria	4½
Winona	‡6
Wolverine	140
Wyandotte	2½

‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	38
Am. Smelt. & Ref.	83⅛
Am.Sm. & Ref., pf.	102⅛
Colo. Fuel & Iron.	32⅞
Federal M. & S.,pf.	‡80⅛
National Lead	75½
National Lead, pf.	106⅛
Pittsburg Coal	‡10¼
Republic I. & S.	20¼
Republic I. & S.,pf.	71⅛
Sloss-Sheffield	73
Standard Oil	667
U. S. Steel	45½
U. S. Steel, pf.	110⅞
Va. Car. Chem.	43¼

BOSTON CURB	
Ahmeek	‡145
Black Mt.	1⅛
Chemung	‡21
Globe Con.	‡5
Hancock	11¾
Helvetia	3¼
Keweenaw	‡4¾
North Lake	‡7⅛
Ojibway	‡13⅞
Superior & Bost.	‡15½

Furnished by Hornblower & Weeks, N. Y.

ST. LOUIS Mar. 13		
N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie.	.07	.04
Center Cr'k	1.50	1.25
Cent. C. & C.	83.00	81.00
C.C. & C. pd.	80.00	79.00
Cent. Oil	105.00	100.00
Columbia	7.00	4.00
Con. Coal	21.00	19.00
Doe Run	110.00	100.00
Gra. Bimet.	.20	.17
St. Joe	12.00	11.00

LONDON Mar. 17			
Name of Com.	Clg.		
Dolores	£1	5s	0d
Stratton'sInd.	0	2	9
Camp Bird	0	15	6
Esperanza	2	10	0
Tomboy	0	18	9
El Oro	1	3	9
Oroville	0	10	6

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. Mar. 17.
Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.	Name of Comp.	Clg.
COMSTOCK STOCKS		Silver Pick	.06
Belcher	.40	St. Ives	.13
Best & Belcher	.32	Triangle	.03
Caledonia	.13	BULLFROG STOCKS	
Chollar	.07	Gibraltar	.05
Comstock	.25	Homestake King.	.05
Con. Cal. & Va.	.29	Mont. Shoshone C.	1.50
Crown Point	.45	Tramp Cons.	.05
Exchequer	.20	MISCELLANEOUS	
Gould & Curry	.10	Bonnie Clare	.03
Hale & Norcross.	.17	Lee Gold Grotto	...
Mexican	.59	Nevada Hills	1.12½
Ophir	.97	Nevada Smelting.	1.00
Overman	.10	Nevada Wonder.	.80
Potosi	.09	Nevada-Utah	2.93¾
Savage	.10	Penn-Wyoming	.03
Sierra Nevada	.22	Pittsburgh S. Pk.	.67
Union	.22	Rawhide Caol't'n.	.65
Utah	.03	Round Mt. Sphinx	.05
Yellow Jacket	.55		
TONOPAH STOCKS			
Belmont	.80		
Extension	.62		
Golden Anchor	.01		
Jim Butler	.18		
MacNamara	.33		
Midway	.20		
Montana	.69		
North Star	.02		
Tono'h Mine of N.	6.50		
West End Con	.30		
GOLDFI'D STOCKS			
Adams	.02		
Atlanta	.11		
Blue Bell	.02		
Booth	.17		
Columbia Mt.	.10		
Comb. Frac.	.92		
Con. Red Top	.06		
Cracker Jack	.03		
Dia'dfield B. B. C.	.06		
Goldfield Belmont	.06		
Goldfield Daisy	.48		
Great Bend	.17		
Jumbo Extension	.12		
Kendall	.06		
Lone Star	.04		
May Queen	.04		
Oro	.07		
Red Hill	.07		
Roanoke	...		
Sandstorm	.10		

COLO. SPRINGS Mar. 12

Name of Comp.	Clg.
Acacia	‡6¼
Black Bell	....
C. C. Con	3½
Dante	6¼
Doctor Jack Pot.	8½
Elkton	71½
El Paso	48½
Findlay	‡15
Gold Dollar	12⅜
Gold Sovereign	3¾
Isabella	25⅜
Index	....
Jennie Sample	8¼
Jerry Johnson	6¾
Mary McKinney	37
Pharmacist	3¾
Portland	1.01
Un. Gold Mines	5
Vindicator	74
Work	7⅜

Assessments

Company.	Delinq.	Sale.	Amt.
Atlantic, Ida	Feb. 20	Mar. 22	$0.00½
Belcher, Nev	Mar. 10	Mar. 31	0.10
Bullion, Nev	Feb. 24	Mar. 18	0.05
Caledonia, Nev	Mar. 16	Apr. 16	0.05
Challenge Con., Nev	Mar. 19	Apr. 9	0.05
Con. Cal. & Va., Nev	Mar. 23	Apr. 13	0.25
Crater, Ida	Feb. 23	Mar. 27	0.001
East Hercules, Wash	Feb. 15	Mar. 15	0.00½
Lady Washington, Nev.	Feb. 19	Mar. 12	0.05
Little Chief, Utah	Feb. 23	Mar. 16	0.01
North Franklin, Ida	Mar. 15	Apr. 15	0.005
Reindeer, Ida	Feb. 15	Mar. 15	0.10½
Silver Hill, Nev	Feb. 25	Mar. 30	0.05
Socrates, Cal	Feb. 15	Mar. 15	0.20
Spanish Ridge, Cal	Feb. 11	Apr. 10	0.03
Temple, Ida	Feb. 22	Mar. 15	0.005
Utah Arizona, Ariz	Feb. 25	Mar. 18	0.001
Yellow Jacket, Nev	Mar. 17	Apr. 24	0.15

Monthly Average Prices of Metals

SILVER

Month.	New York.		London.	
	1908.	1909.	1908.	1909.
January	55.678	51.750	25.738	23.834
February	56.000	51.472	25.855	23.706
March	55.365	.....	25.570	.....
April	54.505	.....	25.133	.....
May	52.795	.....	24.377	.....
June	53.663	.....	24.760	.....
July	53.115	.....	24.514	.....
August	51.683	.....	23.858	.....
September	51.720	.....	23.877	.....
October	51.431	.....	23.725	.....
November	49.647	.....	22.933	.....
December	48.769	.....	22.493	.....
Year	52.864	.....	24.402	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK.				LONDON.	
	Electrolytic		Lake.			
	1908.	1909.	1908.	1909.	1908.	1909.
January	13.726	13.893	13.901	14.280	62.386	57.688
February	12.905	12.949	13.098	13.295	58.786	61.197
March	12.704	.....	12.875	.....	58.761	.....
April	12.743	.....	12.928	.....	58.331	.....
May	12.598	.....	12.788	.....	57.387	.....
June	12.675	.....	12.877	.....	57.842	.....
July	12.702	.....	12.933	.....	57.989	.....
August	13.462	.....	13.639	.....	60.500	.....
September	13.388	.....	13.600	.....	60.338	.....
October	13.354	.....	13.646	.....	60.139	.....
November	14.130	.....	14.386	.....	63.417	.....
December	14.111	.....	14.411	.....	62.943	.....
Year	13.208	.....	13.424	.....	59.902	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1908.	1909.	Month.	1908.	1909.
January	27.380	28.060	July	29.207	.....
February	28.978	28.290	August	29.942	.....
March	30.577	.....	September	28.815	.....
April	31.702	.....	October	29.444	.....
May	30.015	.....	November	30.348	.....
June	28.024	.....	December	29.154	.....
			Av. year.	29.465	.....

Prices are in cents per pound.

LEAD

Month.	New York.		St. Louis	London.	
	1908.	1909.	1909.	1908.	1909.
January	3.691	4.175	.....	14.469	13.113
February	3.725	4.018	3.868	14.250	13.313
March	3.838	.....	.....	13.975	.....
April	3.993	.....	.....	13.469	.....
May	4.253	.....	.....	12.938	.....
June	4.466	.....	.....	12.600	.....
July	4.447	.....	.....	13.000	.....
August	4.580	.....	.....	13.375	.....
September	4.515	.....	.....	13.125	.....
October	4.351	.....	.....	13.375	.....
November	4.330	.....	.....	13.538	.....
December	4.213	.....	.....	13.156	.....
Year	4.200	.....	.....	13.439	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York.		St. Louis.		London.	
	1908.	1909.	1908.	1909.	1908.	1909.
January	4.513	5.141	4.363	4.991	20.563	21.425
February	4.788	4.889	4.638	4.739	20.875	21.563
March	4.665	.....	4.527	.....	21.075	.....
April	4.645	.....	4.495	.....	21.344	.....
May	4.608	.....	4.458	.....	19.906	.....
June	4.543	.....	4.393	.....	19.000	.....
July	4.485	.....	4.338	.....	19.031	.....
August	4.702	.....	4.556	.....	19.350	.....
September	4.769	.....	4.619	.....	19.563	.....
October	4.801	.....	4.651	.....	19.750	.....
November	5.059	.....	4.909	.....	20.875	.....
December	5.137	.....	4.987	.....	20.625	.....
Year	4.726	.....	4.578	.....	20.163	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.